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FROM SHANGHAI TO BHAMO.*

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Our party was employed by an English capitalist who had obtained mining concessions in the province of Sechuan, and consisted, besides the writer, of Messrs. J. Fossbrook Morris and R. Lockhart Jack, with an interpreter and the usual retinue of cook and servants.

We left Shanghai on January 4, 1900, by the Poi-yang, one of Butterfield and Swire's magnificent river steamers, which reached Hankau (600 miles) on January 7. A delay of eight days occurred before we could get a passage by the Sha-si, a smaller steamer of the same company, to I-chang (400 miles), which we reached on January 20. Here we hired a houseboat, which was dragged up the river by trackers to Chung-king (392 miles), the voyage occupying the time from January 23 to February 22. The Yang-tse, as far as Chung-king, has been so frequently described by officials, explorers, scientists, traders, and tourists, and the river has been so well charted by Father Chevalier, S.J., that this portion of the journey may be passed over in silence.

On March 5 we left Chung-king, our means of locomotion being no longer boats, but horses and sedan chairs, with a numerous following of coolies carrying our loads, and an escort of soldiers, which was changed at every Hsien, or county town, the returning escort always taking back a receipt for us, stamped and signed by the magistrate to whom they delivered us.

The journey from Chung-king to Cheng-tu, the capital of Sechuan (299 miles), took thirteen days. It has often been described by previous

* Read at the Royal Geographical Society, January 13, 1902. Map, p. 416.

travellers, but I may mention the extensive coal-deposits of Lai-feng-yi and Lung-chang Hsien, and the brine-wells of Nei-kiang Hsien, and the endless succession of anticlines and synclines of sandstone and limestone. One brine-well was 675 feet deep, the bamboo bucket being raised from the bore by a bamboo ribbon wound round a whim by a buffalo. Ploughing, harrowing, and hoeing were going on busily, the wooden ploughs being drawn by water-buffaloes. Travelling buffaloes were always accommodated with straw sandals. At Lung-chang we met M. Paul Duclos, of the Mission Lyonnaise, who was on his way to Chung-king. Captain Watts-Jones, who four months later was barbarously murdered at Kwei-hua-cheng, gave me, at Cheng-tu, a tracing of his plane-table survey, from which, as it was certainly a more careful one than any previous survey, it may be said with confidence that Lung-chang is about 18 miles south-west of the position previously assigned to it. At Nan-ching-yih we saw the first of the gigantic bamboo under-shot water-wheels used for irrigation.

Cheng-tu is a city of about three-quarters of a million inhabitants, and an important centre of silk and other industries, which are for the most part carried on in the streets. Here we were well received by the members of the Government Mining Department and were lodged in the Commissioner's yamen, which had been furnished in semi-European fashion for our use. I had an audience of the Viceroy. Surrounded by a retinue of civil and military dignitaries, he received me with great cordiality, and expressed freely his desire that British capital should come to the assistance of Sechuanese industry. He arranged that, for our protection and prestige, we should be accompanied by a Wai-yuan, or official of magisterial rank, red-silk umbrella and all, as well as by a military escort; and that a proclamation commanding respect and assistance should always precede us on our travels throughout the province. Besides experiencing many kindnesses from the missionaries, we met at Cheng-tu an interesting group of native officials, among others the Tartar General, the Provincial Treasurer, the Secretary for Foreign and General Chee, who was "out" with Chinese Gordon.

Cheng-tu Plain is probably the most intensely cultivated portion of the Earth's surface. It is about 70 by 40 miles, and supports a population of four millions. Two facts may be mentioned as showing its quality. It often grows seven crops a year, and it pays to borrow money at 30 per cent. to cultivate it. It was fair in beans and still fairer in rape, but I shall never forget its marvellous beauty when it was covered with poppies of every hue from white to purple. The secret of its fertility is irrigation. Many large rivers enter it, and are immediately seized upon and diverted into channels, which are led over the fields in every direction, turning mills by means of over- or under-shot bamboo or wooden wheels and turbines. The engineer, Li Ping, who devised the scheme of irrigation two thousand years ago, has, very

properly, been assigned a place in the Chinese pantheon, a magnificent temple having been erected in his honour at Kwan Hsien.

Our first excursion from Cheng-tu was to the copper-mines of Tung-ling-tse and back, a journey covering 124 miles, which took fourteen days (April 3 to 16). We were accompanied and introduced by Tong Sing Kow, Managing Director of the Government Mining Department, and a Wai-yuan, Hung, with a guard of soldiers. After passing through the walled city of Pen Hsien, we entered, at Kwang Kau, the valley of the Chian-kiang, a river about the size of the Tay at Perth. Messrs. Jack and Morris mapped its course nearly to its head, as

GEOLOGICAL PARTY'S HOUSEBOAT IN THE MIDDLE RAPID, CHIN-TAN (HUPEH).
(*R. Lockhart Jack, photo.*)

well as the course of a tributary, the Pai-sui Ho, and another stream. This has not been done before, although, no doubt, the valley has been visited by missionaries. The valley afforded some lovely scenery, and formed a strong contrast to Australia, which we had not long left, as there was abundant running water everywhere, and we were scarcely ever out of sight of falls and "staub-bachs" 700 or 800 feet in height. We camped in tents at the monastery of Tung-ling-tse, near the head of the valley, as the house accommodation was insufficient for our large party. We visited other copper-mines on the Pai-sui Ho, chiefly remarkable for the daring though bad engineering of the roads leading to them, as they ascend thousands of feet without

any attempt at grading, and cross ravines and climb precipices by bridges made of a couple of logs or ladders made of notched saplings. I reached places where the snow of the previous winter was still lying, and Messrs. Morris and Jack made an attempt to reach a group of mines on the Chun-chan Shan further north, but were baffled, at an estimated elevation of 12,000 feet, by the depth of the snow. Of course we did most of this work on foot, but our Wai-yuan, Hung, did his part on a saddle on a coolie's back. No Chinese official would do anything so undignified as to walk. Even a coolie, when promoted to be a "boy," soon discovers that he "cannot" walk.

This trip was chiefly remarkable for the enthusiasm with which local officials entered into the spirit of the Viceroy's orders for ensuring our safety. The guards varied in numbers and armament. On approaching Kwan Hsien, for instance, the Peng Hsien guard was relieved by the new one, consisting of 6 black flags, 6 red flags, 2 trumpets, 4 Lochaber axes, 7 tridents, 2 swords, and 25 rifles.

Our next trip from Cheng-tu was a "round" one, to Lung-an and Sung-pan and back *viâ* Kwan Hsien. It took us from April 25 to May 31, the distance being 607 miles. We left the main Pekin Road, which has been travelled by Gill, Mrs. Bishop, and many others, at Se-te Chau, and followed to the north a road leading to An Hsien, which, as it was within sight of the range to the west, gave us an opportunity of laying down the edge of the Cheng-tu Plain with more accuracy than it has hitherto been done. Beyond Sin-tu Hsien, we met a long caravan of Tibetans on mules, and a prisoner, dressed in red, carried in a cage with an official seal across the front of it. Shih-feng Hsien is a centre of tobacco-cultivation, and M'yen-chu Hsien is famous for its paper manufacture. Near the latter, coke comes down in barrows from the hills to the west. An Hsien is a very minute walled city, with an elaborate concrete training wall for the prevention of floods. We were lodged in the clubhouse of the Cantonese guild, consisting of a number of elegant and comfortable buildings among grounds tastefully laid out with rockeries, shrubberies, temples, and ornamental water. Here we enjoyed the agreeable society of some ladies and gentlemen of the Church Mission, and had a call from the Hsien, or magistrate, a brisk and energetic official, who had just been appointed to the government of a district with a bad reputation for robbery. He had begun after the customary method of new brooms, having hanged two robbers and arranged for the execution, next day, of a third, before making his call on us. There are some alluvial gold workings in the neighbourhood of the city, and coal comes from the north.

After crossing some passes to the north, we struck, at Chu-shan, the right bank of the Che-chuen river, which we followed to the north-west to Shih-chuen Hsien. Here, besides some pretty bamboo suspension bridges, we first saw the so-called "Himalayan" bridge, of a single

bamboo rope. We watched a woman attach a load of wood to the rope, seat herself on it, and, after sliding to the bottom of the sag, pull herself and the load, hand-over-hand, to the opposite bank.

After some excursions in the neighbourhood of Shih-chuen, looking at alluvial gold workings in the river (which rises in the snow-capped dividing range between the Min and the Fu), we returned to Chu-shan. The river is one continuous rapid all the way. Striking eastward from Chu-shan, the road ascends 2149 feet (to 5350 feet above

BRINE WELL IN DRY BED OF YANGTSE AT KWEI-FU, SECHUAN.
(*R. Lockhart Jack, photo.*)

the sea) in a mile and a half. Strings of coolies toiled up the steep, laden with wool from Tibet for shipment at Tung-kau, which is approached by a steep descent after passing some coal-mines. The river falls into the Fu a few miles below Tung-kau, where there is a very fine bamboo suspension bridge and a picturesque harbour.

In about 15 miles more to the east, we were in the valley of the Fu, which we followed up to its head. As this part of the journey has already been described by Gill, I need not dwell on it. The river

is navigable, in a way, at least for rafts, as far as Hsiang-ngai pa. The Fu, or Prefect, of Lung-an now resides in the more accessible and agreeable little city of Kiang-yu Hsien, a subordinate official remaining in charge of Lung-an. Consequently, as the name follows the official, Kiang-yu is now known locally as Lung-an, while Lung-an has been re-christened Ping-wu. The circumstance is noted as an instance of the difficulty of identifying Chinese places by their names. There are gold terrace and "beach" workings from Ping-i-pu upwards. A pontoon bridge was noted at Chiu Chau.

Lung-an is a small but busy town, with a remarkable old temple dedicated, I was informed, to the "President of Purgatory." The name may have resulted indirectly from the presence in the town of a Catholic mission. We called at the mission, but found that the father was from home.

From Lung-an to the snow-clad pass of the Hsueh Shan, the valley of the Fu is a gem of beauty, to which artists will surely make pilgrimages when they have exhausted Switzerland, Italy, and Norway. Seven miles above Lung-an, a dilapidated fortified gateway spans the road, the first of the aforetime defences of the Chinese against the inroads of the savages from the west. Hsiao-ho-ying is a fort supposed to have a garrison of a thousand, but actually housing thirty, soldiers. Its defensive wall (which, by the way, is commanded by the hills on the east and west) is pretty perfect, though overgrown with weeds. One corner of it, as well as most of the houses, was carried away by a flood a few years ago, but has been repaired. At Sui-ching-pu we saw some primitive quartz-crushing mills driven by water-power.

The pass of Hsueh Shan (13,360 feet) proved difficult, as not only was there snow over a foot deep, but a blinding snowstorm drove in our faces, and most of the party had some experience of the "mountain sickness." The Chinese suffered more than we did, which may be attributed, I think, partly to opium and partly to "funk." The Interpreter became black in the face, although he and the Wai-yuan rode in chairs all the way, while the others walked. Two of the coolies lay down exhausted in the snow, and had to be carried down. One of the soldiers died of the effects a few days after, while being carried in a chair to the nearest hospital. On the descent to Sung-pan we made our first acquaintance with the Mantzü people, and passed some temples adorned with poles from which prayer-flags fluttered, a sign that we were among people who professed the religion of the llamas.

At Sung-pan we heard that Captain Watts-Jones and Mr. Birch, whom we had seen for the last time in Cheng-tu, had passed through on their way north the day before (May 19). Birch was drowned in the Hoang Ho near Lan Chau on June 24, and Watts-Jones was barbarously murdered at Kwei-hua Cheng a few weeks later by the Deputy Prefect.

We had a heated dispute with the "Ting," or Sub-Prefect, of Sung-pan, who was at first inclined to treat us with marked incivility; but we eventually became good friends, and he and the military bigwigs vied with one another in their attentions.

The exceedingly interesting journey down the Min has been so well described by Gill and others, that there is little to add. Sung-pan is the furthest outpost of Chinese civilization—the last stronghold or edge of the wedge driven into the heart of Mantzü barbarism. I

CAST-IRON URN IN TSING YANG KUNG TEMPLE, CHENGTU.
(R. Lockhart Jack, photo.)

must admit that the Mantzü appeared to us even more pleasing in features and manners than the Chinese; but they were shy, and, as we could only converse with them through the Chinese (who look upon them as beneath their notice), we had little communication with them. The Chinese have opened the road through their country by erecting miniature "kwans," or fortified garrison towns, at short intervals. The dwellings of the Mantzü, built for protection, are exceedingly picturesque.

In the walled Chinese city of Mao-chau, the doors of our inn were scribbled over, while we slept, with anti-foreign inscriptions, which nothing would induce Chu Ling Chung, our Interpreter, to translate, although he admitted that they were "very bad words."

We emerged on the Cheng-tu Plain at Kwan Hsien on May 30, and reached Cheng-tu the following day.

On our return to Cheng-tu, Mr. Herbert Way, who represented an English company, was added to the party, with his interpreter, Nee Sui Ching, and servants. We had a new Wai-yuan, named Chi Hung Chi, a man full of energy and resource. We left Cheng-tu, to visit the mines of the Ning-yuan and Ya-chau prefectures, on June 19. The journey from Cheng-tu to Ning-yuan having been described by Richthofen, Baber, Hosie, and others, it is only necessary to mention a few incidents of our trip.

At Kiung-chau we found that the bridge mentioned by Gill had been washed away by a flood, and was being replaced by one of cyclopean masonry.

At Ya-chau we found that the telegraph line was down and would be useless to us, as telegrams handed in were simply forwarded by messengers. This was a disappointment, as it placed us 111 miles—the distance to Cheng-tu—further from a telegraph station than we had anticipated.

At Kwang-ni-pu we visited iron-smelting works and foundries where large cooking-pots are made, and were informed that skilled experts are highly paid—as they deserve to be—for tasting and reporting on the liquid manures which form no small proportion of the traffic on the roads.

We had heard in Cheng-tu of a famine in the district of which Yueh-Sui is the centre, and had provided an extra supply of rice for the use of our coolies; but it proved hardly necessary, as recent rain appeared to have given a new aspect to the outlook. Indeed, we found the north gate of the city closed, and the magistrate offering sacrifices to stop the rain. The Hsien told us that the day before our arrival Lolo aborigines had made a raid within 2 miles of the city, and killed two Chinese and carried off half a dozen head of cattle. Such events are said to be quite frequent, and Chinese are often carried away into captivity. The Lolos do not wear sandals, and are said to despise the Chinese for being "soft" enough to need them, and for this reason they burn the soles of the feet of their prisoners. The Chinese have opened, and maintain, by means of small garrisons and blockhouses, a road connecting Cheng-tu with Tali Fu through the heart of the Lolo country, but do not attempt a general subjugation. As a rule the Chinese occupy and cultivate the alluvial bottoms along the road, while the Lolos pursue their pastoral calling in their mountain retreats. Many of the Lolos, especially women, carry loads of coal in baskets for

the Chinese. The potato is a good deal cultivated in the Lolo country, though the Chinese do not value it much as a food. Its introduction is said to be due to the missionaries, and to date from about half a century back.

Near Lu-Ku a high-class hæmatite ore is smelted for the manufacture of cooking-utensils, swords, and agricultural implements.

A few miles beyond, we left the beaten road, and, after crossing a ferry on the An-ning river, entered the busy little market town of Sha-a-ba. Another long day's journey brought us across a formidable pass, from 12,000 to 13,000 feet high, and into the valley of the Ya-lung. We left the Wai-yuan at Sha-a-ba to form a link of communication with the outer world, as we had received despatches of a disquieting character relating to the Boxer rising; but we resolved to go on with our work, as, in the event of a Chinese anti-foreign movement extending to this remote district, we reckoned that we were probably safer among the Lolos than among the Chinese.

At Ma-ha, 360 miles from Cheng-tu, the inspection of the gold-mine famous throughout China, and such other mines as we could reach, and preparations for a journey to Burma, occupied us from July 14 to August 10. There are Huntingdon mills and eighty head of water-mills of the rice-mill type. Our residence at the mine was about 9000 feet above the sea, within sight of the Ya-lung river, whose silver streak lay 4000 feet below us, though it was often concealed by a fairyland of fleecy clouds, whose upper surface lay below our dwelling. Telegrams (long delayed) had given an account of the capture of the Taku forts, the troubles at Tien-tsin, and the march on Pekin, where it was said (though we now know that it was exaggerated) that all the foreign residents had been massacred. We were told that the consuls were about to leave Chung-king for Shanghai, with all the foreigners whom they could collect, and that the British consul "most strongly advised" us to go to Burma. Finally, there came a telegram of July 27, that "Foreign Office, London, wired yesterday. Instructions issued take all steps remove British subjects from China." This left us no option, and, our arrangements for providing money, mules, and guides having been completed, we set out (on August 10) on our last journey in China, this time in the character of fugitives.

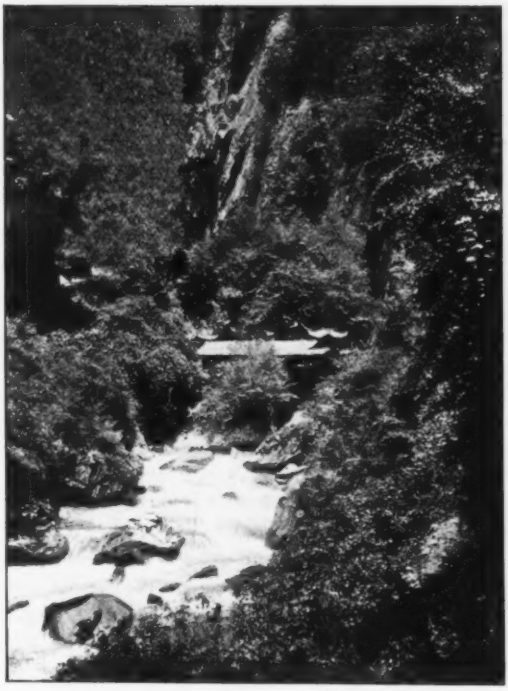
Torrents of rain descended as we literally slid down a spur of the mountain to the village of Mu-li-chang, on the left bank of the Ya-lung (4863 feet). Half a mile above the village we crossed the river the following day in a boat, the ponies swimming. We put up our tents beside a farmhouse called Hoang-ta-ping, on the right bank, opposite Mu-li-chang. Next day, while it still rained heavily, we had to gain a "main road" which we had seen from Ma-ha, high up on the mountain-side. The ascent was very toilsome, and even dangerous. A mule loaded with my papers and silver ingots slipped and rolled down

100 feet, but the ingenious Chinese pack-saddle came off before the mule had made many somersaults. Having reached a summit level of 7550 feet, we descended to a rivulet whose valley can be seen from Ma-ha. The road led up this creek, but was mostly either under water or washed away. Men and animals had to cross a raging torrent, with a bed of boulders or rocks, seven times within half a mile. After 2 miles of this sort of travelling, we left the rivulet and reached a patch of cultivation at 8400 feet, where we were regaled with delicious potatoes. The road attained a summit level of 10,000 feet, and at length wound down by grassy slopes to the village of Lo-ko-ti (9118 feet). The distance covered in ten hours was estimated at 10 miles, but we were still only 5 miles from Mu-li-chang. We camped in tents at the end of the village street, and our Chinese following had the run of the inn, which had a raised wooden floor, walls lined with sleeping-berths, and a great fireplace with two boilers in the middle. The innkeeper was the fortunate owner of a great deal of land, a silver-mine, and five wives. The inhabitants are said to be of mixed Lolo and Sifan origin, and are a little darker than the Chinese. The men are clad in sheepskins. The women have a flowing dress gathered in at the waist by a silver-buckled belt, and a "Tam-o'-Shanter" cap, and are loaded with silver and jade ornaments. Married women wear a broad silver ring on the usual finger.

In 2 miles, the road, after ascending 700 feet, brought us back to the rivulet which we had left the previous day, and a good part of the day was devoted to wading up its bed for the next 5 miles. In one place we were confronted by a waterfall, and had to pile up stones below it till a footing could be made for the pack-animals. A bear was seen among the trees on the bank, and we also saw a herd of yaks.* After climbing out of the valley, we had to camp, in the dark, at an elevation of 13,000 feet, and without water, although plenty of rain fell during the night. Down a spur, 2000 feet, into a gully, and up again to the same level, we found at last 7 miles of good travelling along a grassy ridge with a few patches of pine. We gathered some ripe raspberries and blackberries. Strawberries had been seen, it may be said, two days before, on patches of old cultivation. In 3 miles more we descended to the village of Shu-pao-pu-tze (8760 feet), and put up our tents. The Sifan inhabitants had fled on our approach, with the exception of a few old men and women. We learned afterwards, when they returned and friendly relations had been established, that we had been suspected of murderous and cannibalistic designs. Opposite the village, from a cliff of white marble 5000 feet high, an almost continuous fall of stones kept up a not unmusical tinkling.

* Yaks, it may be mentioned, were very common in the Min valley, though rare in these parts.

Next day the road wound up to a pass 14,000 feet high, with cliffs several thousands of feet higher in the immediate neighbourhood, and then descended by acute zigzags for 4500 feet, in a single mile, into a valley. This valley, which is without water for at least 5 miles, and has not even a definite watercourse, and which is enclosed by walls of 1000 or 2000 feet in height, fell, if the word may be used, into a large rushing stream, believed to be the same which we had headed and on which Shu-pao-pu-tze is situated. Crossing to the right bank



GORGE ON FU RIVER, WITH COVERED BRIDGE.
(*R. Lockhart Jack, photo.*)

of this stream by a covered bridge near a monastery and a natural tower very like the Nelson monument at Edinburgh, we camped in a Chinese farmer's house in the village of Ta-pu-tze (7670 feet). The Lolo dwellings in the lower part of the dry valley are either caves pure and simple, or caves and overhanging ledges, improved by the addition of a "lean-to" of wood or mud and perhaps a rough paling.

A pass between Ta-pu-tze and the next village, Mai-tze ping, was held by a party of Lolos armed with swords and spears. They let us

pass, but our arrival in Mai-tze ping was the signal for a threatening uproar. It appears that we had been taken for allies or mercenaries in the service of the rival village of Ta-pu-tze, and it was not till a Chinese merchant was found, who could interpret the explanations of our interpreter, that peace was restored. Ta-pu-tze and Mai-tze ping cherish an "old grudge" dating from twenty-two years ago, when robbers from Ta-pu lifted four goats from Mai-tze. A few days before our arrival Mai-tze had been robbed of some silver, but two of the robbers had been captured, and were to be sent in chains to Kwa-pit, though a hundred merry men from Ta-pu had made an unsuccessful attempt to rescue them. The village is built on a portion of the hillside too steep and rocky for cultivation, the houses perched on stone terraces, with the byres and stables on the ground floor and the living-rooms above. The head man's house, in which we lodged, was a perfect arsenal of matchlocks, swords, spears, and daggers. The inhabitants were excessively polite, and made the usual presents in Chinese fashion. Their interest in our firearms was profound and respectful.

In two days we had crossed a pass about 12,000 feet high, where we noted the presence of evergreen oaks, junipers, silver birch, rhododendrons, and bluebells, and were met by a red-umbrella man and trumpeter conveying the welcome of the Tussa of Kwa-pit, who had been informed of our approach. At the gate of the Tussa's stronghold we were received with a salute of five guns—more were to follow, but we begged the gunners to desist in the interests of our ponies. The Tussa, a distinguished-looking young man, received us with great ceremony, and heaped every possible kindness on our heads, inviting us to make a long stay, and especially to wait for a tiger-hunt. We were the first foreigners who had ever been within his gates. His family name is Pu Ta, and his official name Chi King Liong. He said his family had been hereditary chiefs for 630 years, and were of Mo-so stock, having conquered the Kwa-pit district inch by inch. Pu Ta had a pair of feathers and the yellow jacket bestowed upon him by the Emperor in recognition of his services against the rebel Li Sieh in Yun-nan four years ago. The castle, on cliffs like the ancient stronghold at Edinburgh, is built on a platform surrounded for the most part by formidable cliffs defended by a wall, in which time has made so many breaches that the frowning gate is no longer the only practicable entrance. The doorposts are hung with an array of raw-hide straps and bamboos, emblematical of the terrors of the law. On the platform of the court-room are six long swivel guns of 1½-inch calibre and a 4-inch "carronade" on a wheeled carriage, made at Cheng-tu ninety years ago, while two rooms and a courtyard form an arsenal or museum in which are the arms accumulated by thirteen generations of rulers, commencing with crossbows and ranging through flint-locks, matchlocks, arquebuses, blunderbuses, and gingals to Winchester rifles,

besides every gruesome oriental form of cutting and thrusting weapon. The private chapel or temple within the walls was evidently very old, and was full of valuable bronzes and china vases, suits of leather-plate armour, and stuffed bears and leopards. It also contained a very old book in Lolo characters, evidently held in great veneration by the attendant priests.

We saw some of the ladies of the Tussa's household, but of course were not introduced to them. Some were Chinese and some Lolo. One of the latter had an Italian type of features, and was artistically painted—not overdone like the Chinese beauties.

On the second and last night of our stay we witnessed a trial for murder, the accused being two men and two boys. The proceedings were orderly and dignified, and the accused, after having had their fetters undone, were allowed to give evidence. One boy-witness, who was evidently prevaricating, was lightly bambooed. The Tussa seemed to weigh the evidence with great care, making notes and occasionally interrogating the witnesses. The upshot was that a true bill was found, and the prisoners were committed for trial at Yen-yuan. Why the Tussa did not settle the case was not clear, as he undoubtedly has the power of life and death. I fancy that he is a humane man, and that such measures are distasteful to him.

At Kwa-pit, we found ourselves, to our astonishment, near the right bank of the Ya-lung, which was in flood and flowing to the north. Four months later, on comparing notes, in Shanghai, with Captain Davies, I learned that he had been compelled by the remarkable bends of the Ya-lung, when travelling from Mien-ning to Chung-tien, to cross the river three times, a few miles north of our course. Our *route* from Ma-ha to Kwa-pit, by which we accomplished 73 miles in nine toilsome days, cannot be recommended. The roundabout way (in part followed by Hosie) *viâ* Ning-yuan, Yen-yuan, and Yen-ching, would probably take no more than half the time.

Southward from Kwa-pit to Ka-la-ba (25 miles) was fairly hard travelling, not improved by a deluge of rain. We lodged at Ka-la-ba in a Lolo tribal dwelling. A well-built mud house was enclosed in a high wall, in one corner of which was a loopholed watch-tower. The house formed a quadrangle, three sides consisting of byres and stables, and a fourth forming the women's quarters, the enclosed square being roofed in as a dwelling for the men, who in the daytime tended extensive herds of cattle. We shared this sleeping-accommodation, which had two central fireplaces and no chimney, with about 150 men, whom we found good-humoured and intelligent, taking an intense interest in such pictures of "foreigners" as we could show them, and, above all, in our firearms. Their own collection of antique arms—rich in matchlocks and tiger-spears—was extensive and imposing.

A few miles before reaching Ka-la-ba we had emerged on open

downs, traversed by a wheel road which runs to Yen-ching. The principal traffic is in firewood for the salt-works, which is carried in light waggons, with a pair of solid wheels, drawn by bullocks.

A portion of the plain was seamed with rifle-pits, and the explanation given was that this was the scene of one of the Tussa's great battles.

Yen-ching is 19 miles south of Ka-la-ba, and the novelty of covering such a distance in a single day was highly appreciated after the mountainous travelling which had gone before. Hosie, who reached the place from Ning-yuan, calls it Pai (or north) Yen-ching. The town is a very busy one. We saw four salt-wells on the left bank of a rivulet. A good deal of wood is used in the evaporation of the brine, but the greater part of the fuel is lignite from a bed, at least 15 feet in thickness, which we visited at Ho-shau pu, 3 miles to the west, meeting on the way thousands of donkeys, mules, and horses, and some men and women, all loaded with lignite. Another centre of the salt industry is at Yen-tang, south-west of Yen-ching, 32 miles by a circuitous and hilly road. It is on the left bank of a river, which we first crossed between Ka-la-ba and Yen-ching, and is now a considerable stream, no doubt a tributary of the Ya-lung, towards which it flows northward. The brine is reached by two shafts, one of which is vertical, and the other on an incline of 45°. In the former the brine is pumped by five successive stages of 15 feet each, in the latter by seven of 9 feet, and conveyed in wooden flumes to the village, half a mile distant, where it is evaporated. As the fuel is exclusively timber, the manufacture must be much more expensive than at Yen-ching. We were informed by La So Tung, the Tussa of Tung-Su, owner of the Yen-tang wells, that their annual output is 100,000 katties of salt (130,000 lbs.), and that the output of Yen-ching is about 900,000 katties.

On the day's march of 17 miles from Yen-tang to Tai-ye-fang (August 26) we crossed the boundary from Se-chuan into Yun-nan, passing some fortified Lolo farmhouses. The inhabitants are a mixed race of Chinese, Sifan, and Lolo breeding.

To Yung-peh (south-south-westward) the road was over a succession of limestone ridges, pitted with "sinks," by passes varying from 8000 to 11,000 feet above sea-level, the country mainly peopled by Sifans. One lofty plain was remarkable for a crop of edelweiss, almost as thick as clover in an English meadow. Ya-shau-ping appeared, from a proclamation, to be the northernmost village in the "ting" or sub-prefecture of Yung-peh. Two incidents marked our stay here. I was bitten by a dog, and the rain forced us to add open umbrellas to our sleeping-gear, one member of the party having to move his bed owing to the fact that the dissolved mud-wall began to trickle down on him. We had opportunities of judging how degenerate the pear can become

after long neglect. The ripe fruit was no larger than a marble, and gritty and acrid to a degree which made it absolutely detestable.

At the Sifan village of Po-lo-ti, the house in which we camped was entered through the byre, and all the others were of the same pattern. Here a noted horse-thief, long "wanted" by the authorities, was pointed out by one of our muleteers and captured by the escort, who brought him before the head man of the village. The latter, assisted by the village elders, heard the evidence, and the sentence was decapitation

THE WAI-YUAN MOUNTAINEERING AT TUNG-LING-TSE.
(*R. Lockhart Jack, photo.*)

unless the prisoner could find a surety for his good behaviour. At night a group of men and maidens entertained us with a dance.

We approached Yung-peh with some misgivings, as in this Chinese city we thought it probable that, if the "rebellion" was really spreading from the south, our reception might prove less hospitable than that of the friendly Lolos and Sifans. We were met by a messenger from the Sub-Prefect, who requested us not to camp outside, where the country people would fear to entertain foreigners in the then state of public

feeling, but to come right on to the city, where he had got an inn put in order for us. After we had been established in the quarters provided for us, the Ting called unofficially and promised us an escort to Li-kiang. The city is enclosed by a wall, which, if not very strong, is at least highly picturesque, covered as it is with a thick growth of evergreens and flowers. A good deal of the intra-mural space is cultivated, and I should think 10,000 would be a liberal estimate of the population.

The domestic architecture of the Chinese portion of Yun-nan possesses characteristics of its own. The houses are mainly built of sun-dried bricks (with straw), and roofed with tiles. They are decorated with painted top-courses and fanciful designs on the gable-ends. The porches are generally painted, and often have black-and-white landscapes or flower-pieces in panels.

We crossed the Yang-tse (left to right) by an iron suspension-bridge 5 chains in length, 27 miles west of Yung-peh, at an elevation of 4400 feet, below the mouth of the river which drains Po-lo and Yung-peh. The Wu-liang falling into the Yang-tse at this point, as given in Bretschneider's map (followed by the "China Inland" map), is an impossibility. It has been eliminated, I observe, from Bianconi's "Carte Speciale de la Chine," which I procured afterwards in Saigon.

A short distance below the bridge two magnificent springs, each a "trouting stream" in volume, issue from synclinal arches of limestone high up on the right wall of the Yang-tse valley, about a mile below the bridge.

The city of Li-kiang (8070 feet) was reached in two days from the Yang-tse bridge. The distance is only 16 miles, but numerous steep ascents, especially the first from the river, made the road very trying.

Li-kiang is a town of such a peculiar plan that it can hardly have been designed by Chinese, whose cities are of a stereotyped pattern. Some of the streets are very steep, and others appear to have been laid out to utilize patches of bare rock with a view to economy in paving. There is a large open market-place. The population presented a curious problem, as it was composed, for the most part, of Chinese men and Sifan and Tibetan women. The explanation was given that in consequence of anti-foreign rioting at Yun-nan Fu, some missionaries, whom the officials had requested to leave the country till better times, had set out for Ta-li, but had been stopped halfway, whereupon 2500 soldiers had been sent from Li-kiang, with an equal number from Chung-tien, to the scene of the disturbance. The "soldiers" sent from Li-kiang must have been chiefly Sifans. Were the Chinese acting the part of David towards Uriah on a large scale?

The officials were inclined at first to treat us with scant courtesy, sending excuses for not calling and orders by their servants to go to Ta-li. On the second day, as this state of affairs might have become

embarrassing, I went to the Hsien's yamen with the interpreter and argued the matter out. The Hsien firmly refused to be responsible for us if we went to Chung-tien, where, he said, the people were turbulent and strangers were always robbed, and he did all he could to induce us to go to Ta-li. Atentse (Captain Gill's *route*) was impossible because the road was washed away, and for a hundred other reasons. All he could do was to give us guides and an escort to Wei-si, whence we could proceed up the Mekong valley. This appeared to force us too far west, but as we afterwards ascertained that the position of Wei-si is incorrectly given in the maps as west of Shi-ku, whereas it is really north-west, the hsien was in the right.

CH'A-ERH-NGAI, A TYPICAL FLAT-ROOFED MANTZU VILLAGE, MIN VALLEY.
(*R. Lockhart Jack, photo.*)

The Tibetan guide and muleteer, Ta-er-do, who had followed us from Ma-ha, turned back at Li-kiang, taking with him his exhausted animals and his childlike ignorance of the country through which he had professed to guide us. We set out on the morning of September 6 on a west-north-west course, and, after rounding the south end of a lake, reached, in 10 miles, the Llamaserai of Lu-su-ba, where we camped for the night. The priests, of whom there were about a dozen, had been themselves locked out of the principal rooms and the temple, in the absence of the Llama, but they gave us the use of a verandah, on which we made ourselves very comfortable, with the addition of a

tent "fly" hung up to make a fourth wall and keep out the rain. There are some nuns attached to the establishment, but we only saw one of them.

We reached the Yang-tse on September 7, and, after a hasty lunch in a llamaserai at Shi-ku, camped at Mu-chi-ti (6740 feet). At Shi-ku the Yang-tse makes a sharp bend to north-north-east, and I gather from Amundsen's narrative that it must keep this course for about 65 miles before turning to flow southward to the east of Li-Kiang.

The journey up the right bank of the Yang-tse presented no features of note except the large numbers of Tibetan carriers and the style of our sleeping-accommodation, which generally was a hayloft in the upper storey of a farmhouse furnished with the family coffins. We left the river at Ku-tu-wa, on the edge of the Chi-tien plain, and, after a picturesque climb past villages which were always gay with the llama prayer-poles, reached the Llamaserai of Lu-tien (8440 feet). There we arrived a little in advance of the Llama, who was out on duty, but he returned in an hour, and unlocked the best rooms of the establishment and did the honours with a fine old-fashioned courtesy. It was interesting to learn that he, with a great train of priests and coolies loaded with baskets of prayer-books, censers, drums, trumpets, and matchlocks, had been out for three days consecrating an addition to a farmhouse, and that the fee charged was ten taels, or thirty shillings. He was dressed in red serge robes, with a jacket of red plush, and seemed to be about eighty years of age.

The pass (12,000 feet) west of Lu-tien has an evil reputation for robberies committed by bands of men armed with crossbows and poisoned arrows. Our local guard, and most of the travellers whom we met, were armed with crossbows.

A steep descent brought us to Wei-si (7480 feet), a large village or small town, nominally a ting, or sub-prefecture, and the seat of a Hsien, or District Magistrate. The main street is paved and very steep. The town population is mainly Chinese, while the suburban and labouring classes are for the most part Sifan or Tibetan.

Following a tributary of the Mekong to the north-west, we passed Ka-ga, the scene of Cooper's imprisonment, forced marriage, and other adventures during the Mohammedan rebellion, and reached the Mekong in two days. It may be noted that all the bridges between the Yang-tse and Mekong are wooden cantilevers. The Mekong itself is spanned by numerous single-rope bridges of the so-called Himalayan type.

At Hsiao (Little) Wei-si we were fortunate enough to meet the Abbé Tintet, missionary "*apud* Tibet," who had been on the spot when Prince Henri of Orleans passed through on his way to Kampti, and had since read the account of the journey. He impressed upon us the difficulties of the *route* which we proposed to follow—starvation, sickness, uninhabited wastes, snowfields, tigers, hostile Tibetans given

to cutting rope-bridges, and so on. One of his own missionary colleagues was living in a state of siege near Chamutong. So late in the season the snow might be expected any day, and if we did not perish in the mountains we might have the luck to get back and put in the winter at Chamutong. There was, besides, the certainty that our Chinese followers, demoralized by the tales they had swallowed, would desert us in a body. Reluctantly admitting the force of the Abbé's arguments, we gave up the attempt on Kampti. The Abbé informed me that Major Manifold and Captains Ryder and Davies had passed through Wei-si in April, 1900; and, after an unsuccessful attempt to

PEAK NORTH OF LI-KIANG FU.
(*Watts-Jones, photo.*)

reach Kampti, had gone eastward *viâ* Li-tang. As their party had a sepoy following, while ours was Chinese, and one of us (Mr. Way) was crippled, we felt that we were not likely to succeed where they had failed.

Our return journey to Shi-ku was marked by no incidents of importance, except the loss of Mr. Way's riding-mule, which was stolen from the stable during the night of our stay at Wei-si. The magistrate made a great show of zeal for its recovery, giving orders for the closing of the city gates. The gates, in the absence of a wall, serve little purpose except that of ornament, and it is needless to say that the mule was never recovered, though it is a consolation that the magistrate

acknowledged his liability for its value. Once more we escaped robbery at the hands of the cross-bowmen of the Mekong-Yangtse pass, perhaps owing to the showy guard which accompanied us. From the pass, which still retains the scars of the entrenchments which played an important part in the Mohamedan rebellion, a clear day enabled us to see and take compass bearings to a series of snow-clad peaks in a range occupying the bend of the Yangtse north of Li-Kiang. Subsequent cross-bearings from Kien-chuan enabled us to locate these peaks with an approach to accuracy. I am led to assign to the highest of these peaks an altitude of about 20,000 feet by the following considerations. The winter had not set in, no snow had fallen, and the heat of the sun must have been daily melting the lower snows. As long before as May 30, we had found the snow-line at 13,000 feet in the pass of Hsueh Shan, five degrees of latitude north of where we were now. After leaving Ma-ha, we had passed close to heights of at least 15,000 feet, on which there was not a particle of snow, and of course we were prepared to find the snow-line rising as we approached the equator. I am ready to maintain, with the confidence born of long experience, that the highest of the peaks visible from the pass rose at least 5000 feet above the snow-line.

Besides the peaks to the east, we saw from the pass a line of snowy peaks between the Mekong and the Salwen.

Leaving the Yangtse at Shi-ku, we reached Kien-chuan on September 23. The Hsien informed us that he had received a despatch from the Viceroy enjoining him "carefully to protect all foreigners, including missionaries, as China was now on friendly terms with all nations." Entering into the spirit of his instructions, he not only provided the usual local guard, but sent a courier ahead of us to post up a proclamation to the effect that we were neither missionaries nor consuls, but good people who had been sent for by the Empress to assist the Chinese in opening their mines, and were now returning to our own country. We found this proclamation at Tai-ping pu, six stages on.

Adhering to our policy of avoiding the large cities, we left the Ta-li road a few miles beyond Kien-chuan, and followed, in a southerly direction, the river which flows through Yang-pi into the Mekong. This valley has numerous villages and small towns, but there are many evidences of a much greater population prior to the Mohamedan rebellion. The paved and neglected road was unusually bad, even for China, and, not unnaturally, our people were inclined to dawdle on various pretexts. An attempt to hire local guides disclosed the singular fact that there was "no purchase in money," as nothing but cartridges (which we were not prepared to part with) would tempt them.

At Chau Ho we saw rock-salt. So far as I know, this is the only place in China where the rock is worked, although brine-wells are plentiful.

At Yang-pi, where we joined the main road from Ta-li to Bhamo, we

heard of a curious effect of the state of unrest. The small local officials had been notified that, in consequence of the Boxer "rebellion" they were to omit their annual visit to headquarters, so that the usual promotions and honours (buttons) were missed for the year.

At Tai-ping pu the telegraph line from Yun-nan Fu was met with. It followed the road to Bhamo. It was in a marvellous state of bad construction, disrepair, and neglect. At Bei-to-pu we were rejoined (October 1) by a corporal of the Cheng-tu escort, who had been sent from Kien-chuan round by Ta-li with telegrams. He reported that he had found the city strongly guarded, and that he had been strictly examined by the civil and military officials on the subject of his rela tions with foreigners and our business and associates. It was only when it was elicited that we were on visiting terms with General Chi of Cheng-tu (who had been "out" with Gordon, and who turned out to be a friend of the Brigadier-General), that the telegrams were sent and he was allowed to proceed.

There is no need to describe the often-described road from Yang-pi to Teng-yueh. In the map I have adopted a survey of the road made for the Telegraph Department by a Danish surveyor, and which is, no doubt, more correct "than any heretofore." At Yung-chang our credentials procured for us a friendly welcome from the officials, in spite of a deputation of the leading men of the city, who demanded that the Hsien should inquire carefully into our antecedents, and if we were found to be missionaries, runaways, or bad characters, should send us back to Ta-li. A herald was sent ahead of us to Teng-yueh to proclaim, with beat of gong, in all towns and villages, the harmless and even praiseworthy nature of our mission. A further difficulty presented itself, which threatened to have serious consequences. A corporal had been sent ahead to make a bargain for fresh mules, but when we arrived the head muleteer repudiated the bargain on the ground that his "Union" forbade carrying for foreigners. The Hsien, with whom we had become friendly, sent for the ringleaders, and, failing to convince them that we were an exceptional kind of foreigner, awarded four of them two hundred blows of a bamboo each. We were hardly prepared for the employment of this argument, and were greatly relieved when the muleteer who had served us till his beasts were well-nigh spent volunteered to take us to Teng-yueh. Here also our Chinese followers, with a few exceptions, having been "crammed" with tales of the dreaded "fever valley" (the Salwen), declared their intention of leaving us. It appeared that they were almost certain to die. If not, one account said that their wives would prove unfaithful, and another that it was the custom among men contemplating the feat to write to their wives beforehand and give them permission to look out for other protectors. To the argument that strong young fellows were more likely to survive than an old man like me (in China one soon learns to make

the most of the *prestige* derived from age), a soldier returned the answer that "foreigners were very strong in their insides." It was only after two days of weary argument, and the promise of a pill which would make them fever-proof, that the men were induced to go on.

The Salwen was crossed (October 10) without so much as a headache, the promised pill having first been duly exhibited. I have seldom seen a prettier valley, nor one which I should have expected to be more healthy. The valley is cultivated, and is crossed daily by crowds of carriers; but it has got a bad name, and my belief is that many Chinese die of sheer "funk" in crossing it. From Marco Polo to Gill and Colquhoun, travellers have borne witness to the popular terror inspired by the place. We saw a village at the western end of the fine suspension-bridge over the river, which had been burned down a few years ago on account of an outbreak of plague, the inhabitants having migrated to higher ground. Where in China has plague *not* broken out one time or other?

Teng-yueh has a good deal of waste land within the walls, but is still a populous city, the chief industry being that of the lapidary. Jade-cutting and jade-speculation seem to employ the energies of the greater part of the populace. There was said to be an army in the city "watching the British frontier." The Chun-tai, or General-in-Charge, who was said to be burning to avenge a "massacre" of a "simple pastoral people" on the border by sepoys, and to be only waiting for orders from Yun-nan to march against the British army, seemed reluctant at first to do anything for us, but the Ur-Fu (Assistant Prefect) stood our friend, and ultimately we were furnished with a safe-conduct and an escort, under an officer of higher rank than usual. It is almost needless to say that at Bhamo we heard quite another version of the border affray.

Beyond Nan-tien, a stone bridge crosses the river which we had followed down from Teng-yueh. The road to Manwaing formerly crossed this bridge and followed the right bank of the river, and many previous travellers have described it. Within the last few years, however, the Chinese have abandoned it to the "wild men" (Shans or Kachins?), and kept to the road on the left bank. At Lang-sung kwan, a bridge is being built over a large tributary stream, and, if it is ever completed, will be a great work. The deck, of squared stones, is supported by pairs of squared stone posts mortised into squared stone beams.

Shan villages now became numerous, but any description of them is rendered impossible by the custom of barricading the ends of each and forcing the public road to go round the outside. They are generally surrounded by a mud wall and a clump of well-grown bamboos. The roads are often lined with shade trees—an idea which does not seem to have occurred to the utilitarian Chinese mind.

The Tussa of Muang-la, a great chief among the Shans, had heard

of the approach of a party of foreigners, and no doubt our numbers had been greatly exaggerated, and he could not tell whether we were friends or foes. His stronghold is on the right bank of the river; but on our arrival at Ju-chen on the left bank, we were met with the information that he had sent his brother to warn the townsmen that we were to get neither food nor shelter. The awkward situation was relieved, before matters had become serious, by the arrival of the belated officer who carried the Teng-yueh general's safe-conduct. We were then invited to occupy the Tussa's shintai (guest) yamen, which was unusually sumptuous. The Tussa is literally "Lord of Two Elephants," which

WOMEN OF LI-KIANG FU.
(*Watts-Jones, photo.*)

were much admired by our Chinese following, who had never seen such animals before. They were carrying enormous baskets for the reception of the dues which the Tussa exacts from every market. If my information was anything like correct, he must derive an income of about £7000 per annum from this source alone.

Near Ju-chen the river which we had followed down from Teng-yueh falls into the left bank of the Tai-ping Ho. The latter, a broad and sluggish stream, is navigable for boats down to beyond Manwaing, but a short distance below the town it tumbles through gorges in which it must fall something like 3400 feet to Myothet.

According to Bretschneider and Bianconi,* the Lung-kiang rises

* Bianconi's 'Carte de la Chine, Physique et Politique,' is published at Paris without date, but evidently recently.

further north than the Tai-ping Ho. This is probably a mistake, as it is a smaller river. So far as I can discover, no European traveller has seen the head of either.

We crossed the Tai-ping by a ferry above Manwaing, and spent a night in that flourishing town, which owes its prosperity to its position as a depôt for the carrying trade on the Chinese side of the range dividing it from Myothet in Burma.

Our interpreter told us that the question of the hour in Manwaing was, "Why did not the Chun-tai at Teng-yueh kill these foreigners instead of sending soldiers to protect them?"

At a creek 2 miles below Manwaing is a monument to the memory of Margary, who was murdered in 1875, by the "wild men," according to the Chinese, although the evidence leaves little doubt that the murder was done by order of the Chinese officials. Here the river enters into gorges, and the road leaves it and ascends, to an altitude of 5070 feet, a series of ranges inhabited by Kachins.

The Kachins, a predatory tribe, used to attack and rob the Chinese, till, by the intervention of the British, they were induced to compound for their right to rob by a toll on travelling merchandise. The Chinese say that this peaceful levy was little to the liking of the Kachins, who gradually lapsed into their ancient habits. Till 1896 they were very "bad," and carriers used to wait till they were at least 200 strong before crossing the mountains, but since then a chain of forts and garrisons had been established to keep the road open. We were hospitably received at some of the garrison villages (kwans). We counted six fortalices within as many miles west of Pongdsi. They are blockhouses surrounded by double trenches and *chevaux de frise*.

The Kachin villages often consist of a single long house with straw roof and wooden floor, used as a common dwelling. According to the Chinese, the Kachin men do nothing but "walk about with a gun and a knife," while the women do all the work, which no doubt means that the men live by hunting. We observed a great preponderance of women in the market. Near Pongdsi we noticed a number of elevated chairs and couches, too lightly built for human seats, and were informed that they are used on festive occasions, when idols are enthroned and invited to partake of the slaughtered cattle.

On October 20 we crossed the Hung-ma Ho and were in Burma, the Sepoy guard offering convincing evidence that we were at last clear of China, and once more under the British flag. We camped at the telegraph-office, and communicated with friends in England and Australia. The following day we crossed a jungle-clad range, and reached Myothet at noon. Myothet is the head, or nearly the head, of boat-navigation, and so cannot be much above the level (430 feet) of Bhamo. The overland journey from Ma-ha totalled 874 miles, and had

taken us 73 days. We hired a boat, and dropped down from Myothet to Bhamo on the Irawaddi in about six hours.

Bhamo is universally known on the Chinese side as Sin-kai. For three weeks we had been hearing of Sin-kai, which we had been led to believe was some place on the Tai-ping river, and it was from the Chinese telegraph-master at Manwaing that we first learned the truth. Incredible as it may appear, the name Sin-kai was unknown to the civil and military authorities of Bhamo. We learned afterwards that Colquhoun had "discovered Sin-kai" some years before us.

Our followers, having been paid, revelled for a few days in the joys of shopping and riding in "gharries" before starting on their long home tramp, varying from 500 to 1500 miles, on which I have since learned that three of them died. Only the interpreter and the cook and boy accompanied us to Shanghai, to which we returned *viâ* Saigon, after short delays in Bhamo, Mandalay and Rangoon. As events turned out, it is possible that, had we known, we might have reached Chung-king in safety, and found shelter on the *Pioneer* steamer, which, after her first trip up the rapids, was "commandeered" as a British gunboat.

Travelling in China is not exploring. There is probably no portion of that great country which is not well known to some timber-getter, hunter, or medicine-collector, each in his way as much of an expert as any Australian or African bushman. There are even official maps of every province, but beyond conveying in diagrammatic fashion some idea of the relations of river systems and mountain chains, they are of little value for geographical purposes. In the map attached to this paper, there will be found some additions to our knowledge of the geography of a country which, however well known to the natives, is but little known in the West. These additions are chiefly in the valleys of the Ya-lung river, the upper Yang-tse, and the tributaries of the Mekong, and include an approximate location of some ranges which rise above the snow-line. It is to be regretted that, owing to the attitude of our Chinese following towards them, our intercourse with the interesting Lolo, Sifan, Tibetan, Shan, and Kachin races was very restricted; but still, though, from our inability to enter freely into conversation with these people, we had to travel among them very much as deaf and dumb men might, we enjoyed some opportunities of observing their dwellings and customs.

The question of railway communication between Burma and Western China is bound to become acute within a very few years, in spite of the attitude recently taken up by the Government of India. At present a British railway approaches the Chinese border at Kun-lung on the Salwen, and a French railway at Lao-kaï on the Red River. I do not regard either as a strategic railway from a military point of view, but from a commercial standpoint, the question of which country first

obtains a footing in Western China is of the highest importance. The French aim is Yun-nan Fu and the Yang-tse, while the British is Ta-li Fu and the Yang-tse. They are both perfectly legitimate commercial aspirations, but if the French get to Yun-nan Fu while the British do not get to Ta-li Fu, a formidable barrier of French "influence" will be interposed between Burma and Western China. Both lines will be difficult to construct, and perhaps the British line will be more difficult than the other, although there are only two ranges between Kun-lung and Ta-li. After all, the distances, as the crow flies, are about equal—160 miles from Kun-lung to Ta-li, and 165 miles from Lao-Kai to Yun-nan. No traveller who has seen the long caravans of coolies and mules carrying the products of the West—petroleum, candles, steel, tinned milk, tobacco, wool, cotton, and umbrellas—from Bhamo to Ta-li in spite of the frightful difficulties of a badly engineered and ill-kept road, can doubt that even now a desire to trade with Burma exists in China. To Western China the navigable Irawadi *is* the seaboard, and for that reason the possession of Bhamo (Sin-Kai) has been an age-long aspiration of the Chinese. The coming rejuvenescence of China has to be reckoned with. Whatever the Japanese have done, the Chinese are capable of doing. After they have had a couple of generations of such progress as the Japanese have made, it would surprise me if the western Chinese do not propose to build railways to give themselves the necessary communication with the sea through Burma and Tonkin.

Before the reading of the paper, the Chairman, Sir HENRY W. NORMAN, said: I am sure you will all be very sorry to hear that Sir Clements Markham, owing to slight indisposition, is not able to be present here this evening. Dr. Jack will now read a paper containing an account of his journey from Shanghai to Bhamo. I may just mention that Dr. Jack is an old acquaintance of mine, having served in Queensland as a geologist of considerable repute under the Government, not only during the time I was there, but some years before, and for some years afterwards. I will now ask him to read his paper.

After the reading of the paper, the following discussion took place:—

Mr. A. R. COLQUHOUN: The paper read this evening by Dr. Logan Jack forms a most useful addition to our knowledge of a most interesting and, I may say, fascinating part of the world, and I am sure we all regret that the troubles which occurred during the time of Dr. Jack's visit made it necessary for him and his companions to leave before he was able to complete his studies. There arose out of these troubles one fortunate result, namely, that Dr. Jack and his companions were compelled to make their exit from China to Burma through a most difficult and most dangerous country, large divisions of which had before never been trodden by the white man. I think it must be of interest, and it must be also extremely gratifying to the Fellows of this Society, to remember that among the many explorers who have spent their energies in this region of North-West China, no fewer than three or four medallists of this Society can be numbered, and to those may be added a very large number of Fellows who have done good yeomen service in both Sechuan and Yun-nan. I merely recall the names of Augustus Margary, Captain Gill, and Colborne Baber, and among the very many Fellows,

whose name is legion, I venture to recall that of a lady—I believe she is a Fellow—at any rate a lady who has read most admirable papers before this Society, namely, Mrs. Bishop, the well-known traveller. Dr. Jack has drawn our attention this evening to the most wonderful scenery that is to be witnessed in South-Western China, of which we have had a great number of examples, and I can bear testimony to the accuracy of Dr. Jack's remarks in this respect. We must all hope with Dr. Jack that some of our artists, when they have exhausted the hackneyed ground of Europe, may find their way some day to this fascinating region, and bring back to this country reproductions of some of the most wonderful scenery to be found in the whole world. It is interesting, I think, to note that in this immense province of Yun-nan, the most south-western of the whole of China, during the Boxer troubles which occurred a couple of years ago, this country had not one single representative in this huge province, and the representation of this country actually devolved upon a very junior member of the Chinese Customs Service, a young fellow who was then resident at the small border town of Ssumao. It is matter for regret that this country is not more fully represented in the province of Yun-nan. I believe that at present there is one British consul in that province, and he happens to be a most admirable official; but he is relegated to a little out-of-the-way corner in the western part of the province, a place of no importance whatever, and it must be regretted that at a time like this Britain is not represented at the one place in the province where we ought to be represented, viz. the capital of the province of Yun-nan-fu, a place where, I may mention, very important events are in course of evolution at the present time. Some of us would perhaps have liked to hear from Dr. Jack some expression of opinion as to the value of Sechuan, but doubtless his omission to tell us what he thinks of that part of the world is due to the necessity of a sudden return from that country, and we must hope that some day he may be enabled to return there and give us the results of further scientific study. The most important point in the whole of this very important paper of Dr. Jack's this evening is the portion where he deals with the question of railway communication between Burma and the Yang-tse. There is no time here, nor is this the place, to enter into a full discussion of this question, but I may mention that there are many men—and among them myself—men who have studied this whole question, and who have examined it on the ground, who are of opinion that such a railway must and will yet be made. Dr. Jack has alluded in his paper to one very important feature of that question, and that is where he points out the grave danger of what he calls an insurmountable barrier of French influence being created in this hinterland of ours. In conclusion, I thank you for the attention you have given to me, and I ask you to join me in thanks to Dr. Jack for his admirable paper.

Mr. W. R. Carles: I suffer under the disadvantage of never having travelled in West China, but there are two points in Dr. Jack's interesting and valuable paper to which I am glad to have an opportunity of referring. In the first place, I should like to draw attention to its great geographical value. In the map which has been furnished to the meeting, the dotted lines show that much of the course of the rivers is problematical. The dotted lines might even be extended to include almost the whole course of the rivers, with the exception of a few points which have been fixed. Dr. Jack has spoken of "travelling in China not being exploring." He might have said that travelling in China is the correcting of Chinese maps. In the wilds through which he passed, the rivers are laid down in Chinese maps as following a straight line from north to south. The acute angle of the Yang-tse near Li-kiang, where the river takes a long strike north-east, represents a discovery made some seven years since by a French traveller, Mr. Bonin. The similar sharp

angle described by the Ya-lung represents a discovery made by Dr. Jack. The whole of the journey made by him between the Ya-lung and the Yang-tse is over ground which had never previously been described by any foreign traveller.

In speaking of the gold-mines at Hama as well known, I wish to mention that practically nothing is known of the production of gold in China. In one of the best works of modern years on West China, gold is only once mentioned. It is known that a certain amount of gold-washing is done in the beds of rivers in West China, from which the workers derive a very beggarly living, and it is believed that part of the gold obtained finds its way overland to Peking. But there is really nothing known of the production of gold in West China, its annual yield, or the quality of the ore. The only ports which export gold to foreign countries are the northern ports, Newchwang, Tientsin, and Chefu. From the Yang-tse there is no export. The information acquired by an expert such as Dr. Jack would be a very valuable addition to the knowledge of China, and I trust that he may find it possible to give it to the public.

Mr. M. F. A. Fraser: I am afraid I cannot add much to the very interesting paper Dr. Jack has given you as regards land travelling, but I can perhaps give you something interesting about water-travelling, as I have spent some months of my life in the years 1899, 1900, and 1901 in travelling on the Yang-tse river in steamers, and I am of opinion that navigation from Chung-king to Cheng-tu, over 500 miles, with Dr. Jack's permission—he says it is 300 odd miles, but I believe it is 500; at any rate, it seems like it when you are travelling—I believe that this navigation will never be possible in winter, but will only be possible for about six months in the year when the river is full. Even at that time the pilot of the British fleet on the Yang-tse is of opinion that the work is so wearing that no captain could carry on such a business long without becoming utterly exhausted. The whole of the time one goes up and down a series of most frightful rapids, and if Dr. Jack had come down in winter he could have seen something very exciting. It made my hair stand on end. There are drops of 7 feet in a small area, and these are very frequent. From Chung-king to Sui-fu there is a piece of water which is perfectly navigable. I have been on that on the British gunboat which went 6 miles over the ground against the current and 15 with it, while in the *Pioneer* we did, I think, in four consecutive hours 40 miles, 10 miles over the rapids, and so I believe there is a future for steam navigation from Chung-king to Sui-fu, 250 miles; but for the rest I believe there will only be travel for six months of the year. That is all the information I have on the subject.

Captain Pottinger: I have very little to say, except that I was employed on the survey for this proposed railway between Burma and China. While waiting for one of our engineers to join the party, I made a survey through the rapids. I made plans of most of the rapids, and I made notes of how I thought they could be improved. But I must tell you that I am not an engineer, and that my work is only amateur work. What I think of it is that, compared with the expenses of the railway, if money was spent to improve the rapids, it could be done, and that you would get steam communication along it nearly the whole of the year. The traffic of that part of the river is enormous. About 100,000 tons go up every year, and more than double that quantity comes down, and I do not know any place where there is such a great inland traffic. As regards the railway, all my duty was to report whether a railway was practicable, the probable cost, and a few remarks about trade. But as regards the desirability of building it or otherwise, I was not called on to express an opinion. A part of Yun-nan has been described as being very badly populated and very poor. You must remember that before the rebellion that country was well populated, and if it could support a big

population then it could doubtless do it again. From what Dr. Jack has told you, you know how it was populated, and if a series of famines occurred in that district, what would happen to the people? They must either die or migrate to Yun-nan; and I think there is every prospect of Yun-nan becoming as prosperous as it was before the rebellion. Another point: Dr. Jack has told us very little about the mineral wealth—whether he thinks it is worth developing or not. I was struck myself with the vast quantity of minerals which we saw. There was gold, silver, copper, mercury, and all sorts of minerals. All these things have to be borne in mind in talking of the railway communication. And another thing is that the railway will eventually be built to the Yang-tse some day. There is no room for two. Either we shall build it, or, if we do not, the French will. If Dr. Jack would tell us what he thinks as regards the developing of the country from a commercial point of view, I think it would be most interesting.

The CHAIRMAN: It is very late, and I am afraid we cannot continue this interesting discussion, though I have no doubt there are other persons here who might tell us something important or interesting. I am sure I shall be authorized by you to convey your cordial thanks to Dr. Jack for the most interesting and important paper that he has read, and also for the very beautiful photographs which have been displayed to us.

THE FORMATION OF THE MALDIVES.*

By J. STANLEY GARDINER, M.A., Fellow of Gonville and Caius College, and Balfour Student of the University of Cambridge.

THE Maldive and Laccadive archipelagoes form a long narrow belt, extending down from the coast of India almost from the region of Goa, in lat. 15° 21′ N. to nearly 1° S. The Laccadives occupy the northern half of this belt, and consist of ten reefs with land, four reefs awash, and four submerged banks. Of the reefs with land or awash, nine are atolls, or preserve traces of having at one time had the ring-shaped form. The rest are mere narrow reefs with a certain amount of land and a greater or less extent of shoal-water off them. The three larger submerged banks to the north have depths of 24, 21, and 16 fathoms; the fourth, Elicalpeni, to the east, having only 6 fathoms. The chart, on which we are dependent for their contours, was made in 1860; of course it has been corrected since, but there has been no fresh survey. Although the banks are of considerable size, and although the conditions of life appear, save in the proximity of the Indian coast, to be generally favourable, there is little sign of these shoals assuming a ring-shape, their shallowest soundings being on the centres, not on the rims. There is no direct connection anywhere with the Indian coast, the 1000-fathom line running up between; most of the banks are separated from one another by the same depth, but soundings of 700 fathoms or 800 fathoms only are recorded between some.

Between the Maldives and the Laccadives is a broad strait 175 miles across, broken by the atoll of Minikoi, politically placed in the Laccadive

* Read at the Royal Geographical Society, January 27, 1902.

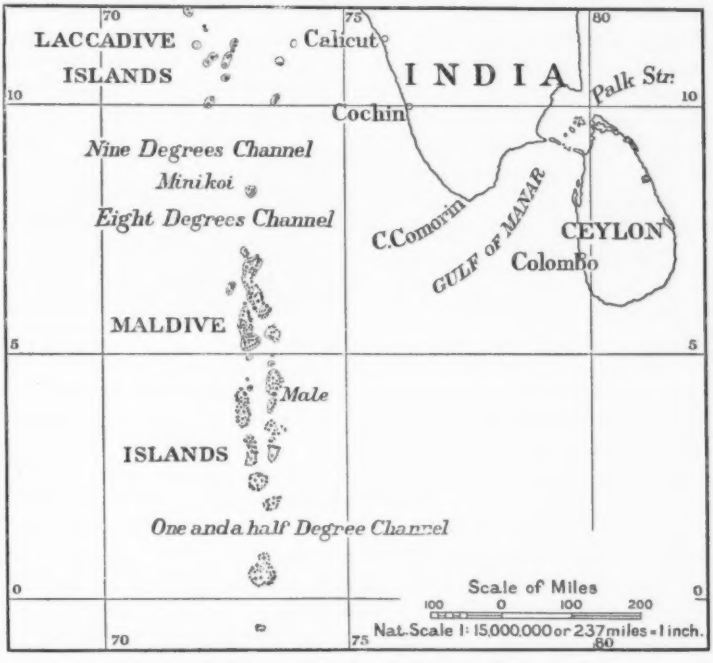
group, distant 110 miles from Suheli Par and Kalpeni to the north, and 70 miles from Ihavandifolu, the most northern atoll of the Maldives. This division does not in any way break down the geographical connection between the two groups. There may be a slight increase in depth—100 fathoms or so—over the 1000 fathoms which separate many of the Laccadive reefs from one another, but between this and the general depth on each side there is in a few miles an additional drop of over 1000 fathoms to the west and 400 fathoms to the east. The Indian ocean, so far as can be seen from the soundings, has in its western half an almost flat bottom at a depth of 2200 fathoms. The 2000-fathom line extends close to the south shore of Ceylon; it is a little further distant from Cape Cormorin, whence it runs down close to the east of the Maldive bank, rounds Addu atoll, and winds up even closer to the west, bending round by Arabia and the African coast.

In 1899 and 1900, assisted by the Royal Society and the British Association, I took a small expedition to the Maldives and Laccadives. Our object was to investigate the interdependence of the physical and biological factors in the formation of atolls. Having visited Funafuti as naturalist to the first expedition in 1896, and subsequently spent nine months in neighbouring coral-reef areas, I naturally took a great interest in the formation of the reefs. My work led me to conclusions so unfavourable to Darwin's theory of subsidence that I had to reject it completely, as applying to the western part of the Pacific.* I still, however, held the opinion that the Maldive reefs were formed by a series of changes from the fringing to the barrier reef, and so to the perfect atoll. No one had visited the region for scientific purposes, since it was surveyed in 1834–6 by Captain Moresby of the Company's service. This officer made most careful and accurate charts, but from his published accounts it would appear that he took little interest in the reefs beyond what his duty required. Darwin, however, was in communication with him, and had the benefit of his experience in writing the first edition of 'The Structure and Distribution of Coral Reefs' in 1842.

My original plan was a much more comprehensive one than that subsequently followed, as it included a full set of soundings round the group and a second visit to the northern Laccadive islands. It could not, unfortunately, be carried out on account of my illness and the increased cost of every commodity, after the war had commenced; the latter, too, prevented my obtaining the services of a steamer for a longer period. As it was, I left England in March, 1899, accompanied by Mr. L. A. Borradaile of Selwyn College, Cambridge, who joined me for certain zoological work. On arrival in Ceylon, we had seven weeks to wait before we could leave for Minikoi, where we were intending to spend the greater part of the south-west monsoon. However, as we had

* See "The Coral Reefs of Funafuti, Rotuma, and Fiji," *Proc. Camb. Phil. Soc.*, vol. ix. pp. 417–503 (1898).

included in our plans a survey of the reefs of Ceylon, we meantime made a traverse of the east and south coasts, and visited the north part and the Jaffna peninsula, all of which is formed of raised limestone. We finally reached Minikoi in the middle of June, and pitched our camp under the lighthouse, the lifeboat of which we used for our work. A survey of the whole atoll was made and large collections obtained; but the work was not as complete as desired, on account of the illness of Mr. Borradaile, whom I had to send to Ceylon on a British India



OUTLINE MAP SHOWING RELATIVE POSITION OF THE MALDIVES.

Company's steamer that came in the middle of July to look after a wreck on the island. I remained, and finally returned to Colombo in the middle of September on the s.s. *Ceylon*, Captain Channer, R.N., kindly giving me a passage. Besides the collecting and survey work, among other points I paid special attention at Minikoi to the currents round the atoll, but much work in the open sea was impossible on account of the heavy storms of the monsoon. The visit was useful as giving a clear insight into the actual condition of a single isolated reef. It also enabled us to prepare more completely and arrange our programme for the Maldives.

In Ceylon I was joined by Mr. Forster Cooper of Trinity College, Cambridge, and we left for the Maldives on October 18, 1899. On arrival at Male we were received by the sultan, who lent us a schooner of about sixteen tons, in which we did the greater part of our work. The sultan, who is a supreme ruler under the protectorate of Ceylon, sent intimation of our expedition to all the thirteen provinces of his group, and told off his third vizier, the *velanamanikofanu*, to accompany us. Our visit was, nevertheless, looked upon with great suspicion, and, although the sultan had given the most distinct orders that we should be assisted in every way, we had to contend throughout against much veiled opposition from the viziers and nobles. Fortunately this was not of much hurt to us, as, our crew, collecting boys and servants numbering sixteen, we were quite independent of the islanders. Indeed, we were able at any time to put a full crew of six into a whaleboat, which we towed about with us, and yet to leave sufficient hands to man our schooner and to dredge.

We sailed without delay from Male to Goifurfehendu atoll, where we visited every part, and made collections with a view to comparing it with Minikoi. November, 1899, a month of calms, was taken up in a slow progress through South Mahlos; but in December, getting strong north-east winds, we were enabled to see more of North Mahlos in twelve days than we had seen in twice that time of South Mahlos; indeed, between us we visited no less than twenty-seven islands, traversed nearly the whole circumference of the bank, and put down over twenty dredgings and a large number of soundings. Crossing to Miladumadulu on December 11, we spent twelve days on that bank, principally among the reefs of the eastern side. Generally we divided forces, Mr. Cooper dredging, while I took our whaleboat and examined the reefs and land. On December 23 we reached Fadifolu, most parts of which one or other of us visited in a stay of ten days. For four days we had to lay up at Naifaro for repairs, our vessel having been severely knocked about in a cyclone we experienced. Finally we left for Male on January 2, 1900, and reached our anchorage there on January 5, having run a line of dredgings down close to the east reefs of the atoll.

The remainder of January and the whole of February were passed at Male and Hulule, a neighbouring island, in making collections and special observations on the currents, tides, and other physical conditions. No work was possible in the schooner for the first half of our stay on account of its being Ramazan, the Mohammedan month of fasting; but in the latter half of February, Mr. Cooper took her, after she had been thoroughly overhauled, for a week's dredging in Male atoll. I meantime had contracted the Maldivan fever, and on March 1 returned to Ceylon in a British India Company's steamer which chanced to call at Male, Mr. Cooper meantime dredging the eastern atolls southwards. I left Ceylon on my return in the s.s. *Ileafaee*, of which Mr. Noorbhai,

a Mohammedan gentleman, gave me a very favourable charter, on April 2, and relieved Mr. Cooper, who joined me in Haddumati. We then had a seventeen-days' cruise in the steamer among the reefs, visiting Suvadiva and Addu, and returning *viâ* Kolumadulu, the two Nilandu banks, and Ari. On our way we put down sixty-seven dredgings, making upwards of three hundred in the whole group. These, together with the reef collections, give a good idea of the marine fauna, but the land fauna and flora were also obtained, two "boys" whom I had trained at Minikoi being especially told off to assist in this work.*

A LAGOON SHOAL WITH SAND ISLAND.

After this premiss it is necessary to return to the Maldives and examine what light its features throw on its own formation. The group may be naturally broken for consideration into three divisions—Addu, Suvadiva, and the remaining banks. The first two are isolated atolls, separated from the rest and from one another by broad channels, the "equatorial" and "one-and-half-degree," the former with one sounding of 1027 fathoms. The two atolls differ from one another mainly in their relative size, Suvadiva covering an area of over 800 square miles, and Addu less than 50 miles; this entails consequences in respect to the various actions still continuing, which further differentiate them. Intermediate to Suvadiva and Addu lies Fua-Mulaku, about which I have no reliable information. It is a reef, the greater part of the surface of which has been converted into land. There are some indications that it may have passed through a phase when it was of atoll-shape, and hence it may be provisionally joined to Addu.

The third division, comprising the main part of the group, and with which I am here principally concerned, consists of a series of banks with a depth of water less than 50 fathoms. Some are surrounded with great

* A full account of the collections and work of the expedition is now being published by the Cambridge University Press in a series of quarto parts under the title of 'The Fauna and Geography of the Maldive and Laccadive Archipelagoes.'

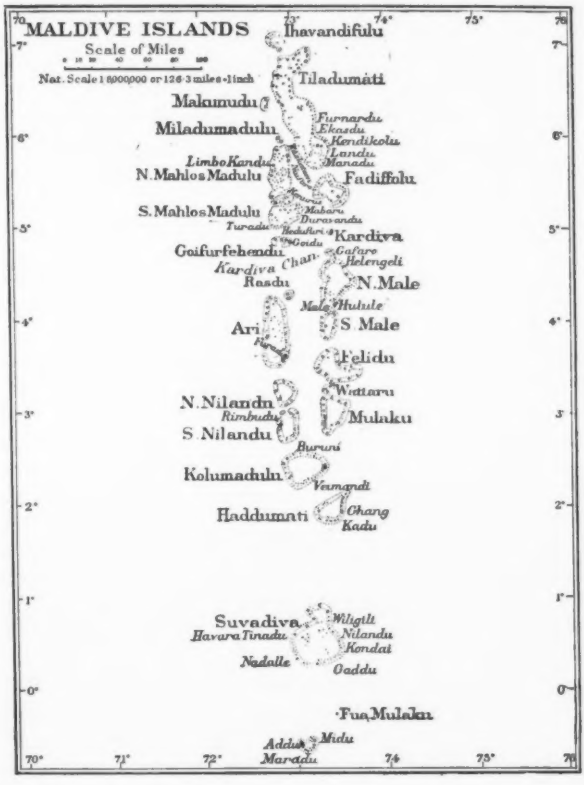
encircling reefs, while others are studded all over with smaller reefs. Of these latter some again are ring-shaped basins with small lagoons—*faro*, as they are called—and others are flat; some have land, but the majority are just awash at the low-tide level. The larger banks form a line, 290 miles long, from north to south, from Tiladumati to Kolumadulu. The line consists of single banks at either end, but of two parallel series in the centre, hence the shape is a narrow oval with blunt points. The different banks are separated from one another by only moderate depths, probably in no case more than 300 fathoms. Ihavandifolu may be an outlier of the division, a least sounding of 601 fathoms having been obtained where the channel is about 8 miles across between it and Tiladumati. Possibly, too, there is a greater depth between Makunudu and either Mahlos or Tiladumati, and there are absolutely no soundings between Haddumati and Kolumadulu.

This large division may be subdivided, perhaps somewhat arbitrarily, into two parts by the Kardiva channel, 28 miles broad, which crosses the double chain between Fadifolu and Gafaro to the east, and Goifurfehendu and Ari to the west. The connections, however, across the channel are clearly indicated by the isolated reefs and islands of Karidu and Toddu east and west. These two resemble Fua-Mulaku, and, like

ROCKY OUTER BEACH AND REEF-FLAT OF ONE OF THE EAST ISLANDS OF NORTH MAHLOS.

it in their development, possibly passed through atoll-conditions. The smaller banks tend to be more or less completely surrounded by surface-reefs, perhaps with land, in whatever part of the group they lie, but the larger banks to the north and south of the Kardiva channel differ from one another in this same quality. To the north the Tiladumati-Miladumadulu bank, 87 miles long by 11 to 20 broad, has, as a whole,

little semblance to an atoll, consisting rather of a series of isolated reefs of no great size. Mahlos-Madulu has a more definite sequence of reefs towards its circumference, but there is no real central basin, the inner part being abundantly studded with surface reefs, some with land. Fadifolu is much smaller, and has a nearly perfect reef to the east, but merely a series of patches to the west. To the south of the channel all the banks of the east series have more open lagoons. Their delineating



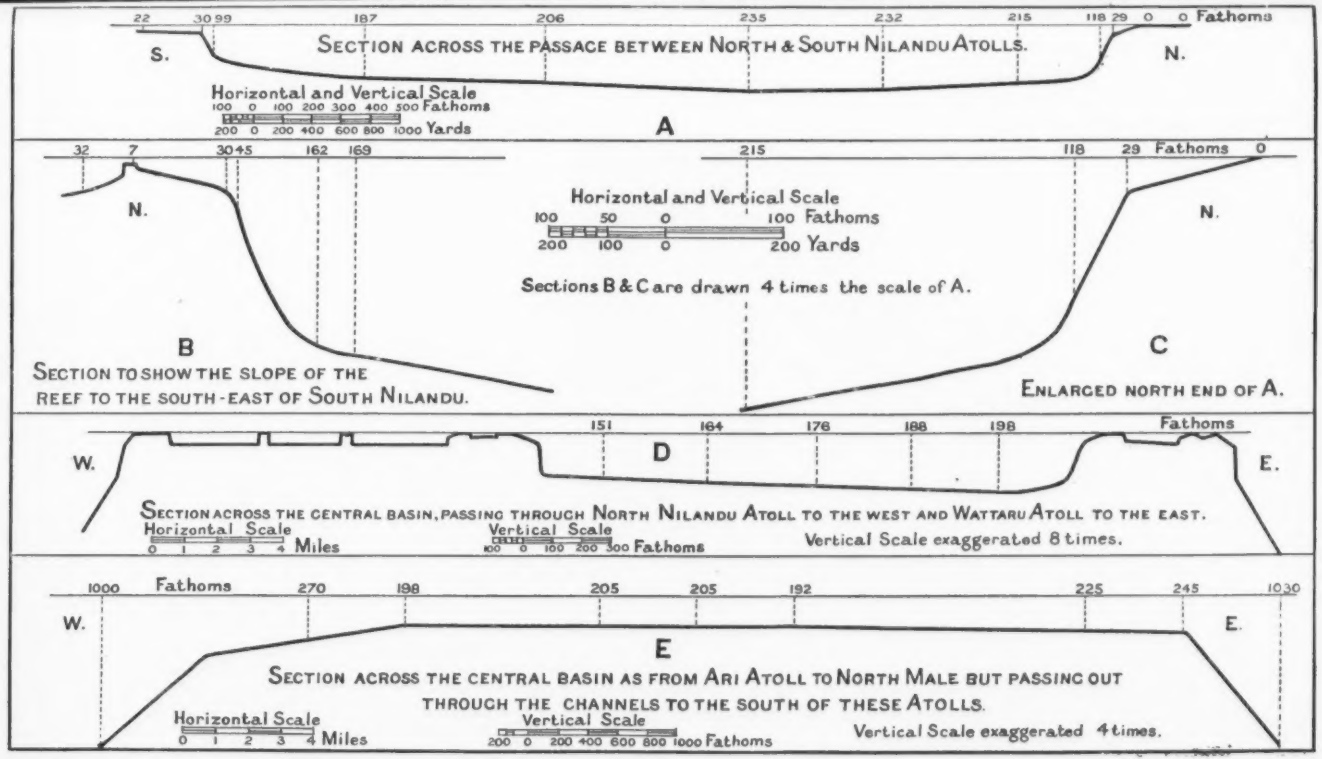
reefs become more defined to the south, until in Kolumadulu is seen a perfectly typical atoll, differing only from the majority of those found in the Pacific ocean in its greater size, being 26 miles in diameter, and covering an area of about 430 square miles. Along the west row the same divergence is not quite so clear, Ari being to some extent interposable between Mahlos and North Male.

Another point of dissimilarity lies in the depths of the banks being

greater to the south than to the north of the Kardiva channel. The average depth on the Tiladumati-Miladumadulu bank is 23 fathoms, Mahlos 25, and Fadifolu 25, while North Male has 29, South Male 25, Felidu 32, Mulaku 32, and Kolumadulu 40. Again, the west line is less marked, Ari having 32 fathoms, North Nilandu 32, and South Nilandu the same. These variations in depths may be due to diverse conditions in the past between the two parts; but, whereas on the large banks the deepest parts are those around which the encircling reefs are most perfect, they would seem rather to be contingent on the greater perfectness of the atoll form to the south. I have no soundings across the Kardiva channel, but from the general contour it is impossible to suppose that there is any geographical separation between these two divisions. Yet there would seem to be a real difference, which was probably due to the diverse physical conditions, currents, winds, temperature, etc., affecting the banks themselves during their formation in different degrees.

The various banks, as they exist at the present day, may be regarded as plateaus, rising to different depths, on the summits of which reefs have grown up to the surface. Again, these banks ascend from a second plateau, which lies at a still greater depth, this towering directly from the basin of the Indian ocean. As far as possible we sounded this plateau, running three lines between the two series of reefs, and joining across six of the channels between the separate banks. These showed that the plateau has a general depth of about 190 fathoms, increasing in the passages to about 240 fathoms. In the channel between the two Male atolls we carried the line out eastwards, getting 1030 fathoms within 2 miles south-east of Hulule reef. This is the sole sounding off the central part of the deep plateau which at all suggests its contour-lines, but there are a few other soundings north and south, which indicate that it is everywhere about the same. A comparison, too, with other similar, better-known banks in the ocean shows the strongest possible inherent probability that its rise is extremely rapid.

There are many gaps in the soundings, which ought to be filled up, but so far as they go, they indicate that the banks of the Maldives arise on a flat plateau, situated at a depth of about 190 fathoms. There is no evidence from which the origin of this plateau may be in any way deduced. It can scarcely have been formed as such either above or below the sea. That it is the remains of a former reef-bank is almost impossible, since there is in the soundings no trace of deeper water in the centre—in fact, of lagoon. Indeed, the depth gradually increases from the centre outwards in every passage that has been sounded, until presumably the more rapid outer drop is reached. The bottom deposits give no direct help. There was no considerable thickness of ooze of any sort, a few coarse coral or shell fragments alone being obtained;


22 30 99 187 206 235 232 215 118 29 0 0 Fathoms
S.
SECTION ACROSS THE PASSAGE BETWEEN NORTH & SOUTH NILANDU ATOLLS.
N.
Horizontal and Vertical Scale
100 0 100 200 300 400 500 Fathoms
200 0 200 400 600 800 1000 Yards
A
32 7 30 45 162 169
215 118 29 Fathoms 0
N.
N.
Horizontal and Vertical Scale
100 50 0 100 Fathoms
200 100 0 200 Yards
Sections B & C are drawn 4 times the scale of A.
B
SECTION TO SHOW THE SLOPE OF THE REEF TO THE SOUTH-EAST OF SOUTH NILANDU.
C
ENLARGED NORTH END OF A.
151 164 176 188 198 Fathoms
W.
D
E.
SECTION ACROSS THE CENTRAL BASIN, PASSING THROUGH NORTH NILANDU ATOLL TO THE WEST AND WATTARU ATOLL TO THE EAST.
Horizontal Scale
0 1 2 3 4 Miles
Vertical Scale
400 0 100 200 300 Fathoms
Vertical Scale exaggerated 8 times.
1000 Fathoms 270 198 205 205 192 225 245 1030
W.
E.
E
SECTION ACROSS THE CENTRAL BASIN AS FROM ARI ATOLL TO NORTH MALE BUT PASSING OUT THROUGH THE CHANNELS TO THE SOUTH OF THESE ATOLLS.
Horizontal Scale
0 1 2 3 4 Miles
Vertical Scale
200 0 200 400 600 800 1000 Fathoms
Vertical Scale exaggerated 4 times.

MALDIVE ISLANDS —SECTIONS.

the *valve* lead repeatedly came up empty, the *snapper* alone giving an occasional sample. The bottom, hence, must have been extremely hard, suggesting almost a current-swept ridge. Indeed, it is to current-action that we must look for an explanation of the origin of the plateau. It is quite unnecessary to repeat the evidence and views of Sir John Murray * and Admiral Sir W. Wharton † as to the action of marine currents in cutting down land. The depth, to which they act, alone requires consideration. Admiral Wharton instanced the remarkably steeper fall at 80 to 100 fathoms in the contours of land exposed to the great oceans as showing the depth to which material from the coasts can be moved. If this is the depth in this position, would it not be much greater

RAISED CORAL-LIMESTONE MASS, SHOWING UNDERMINING AND EROSION.

where there is only a peak, series of peaks, or bank exposed fully to the great oceanic as well as the tidal currents? Even with a rough direction-indicator—a compass with vane which could be thrown out of gear by a messenger—I was enabled to note the directions of the currents down to 130 fathoms off Minikoi and to 150 fathoms between the two Male banks. I further got some comparative results as to the rate of the current with a common river-meter down to 50 fathoms. It should be easy for any well-equipped ship to study their direction, rate, and depth anywhere in the ocean. My instruments were poor, and my results only indicate that my supposition that the great plateau of the Maldives was formed by the cutting down and levelling of land by the oceanic and tidal currents to its present depth, is not unreasonable. The land may have been the Himalayas of a great continental land joining Ceylon to Madagascar, or, as Sir John Murray

* *Proceedings of Royal Society, Edinburgh*, vol. x. p. 507, and subsequent papers.
† *Nature*, vol. 55, p. 390.

suggested to me, a series of volcanic erupted masses. What it may be is entirely a matter of theory, and a question to which the geological study of the Indian continent has so far yielded no clue.

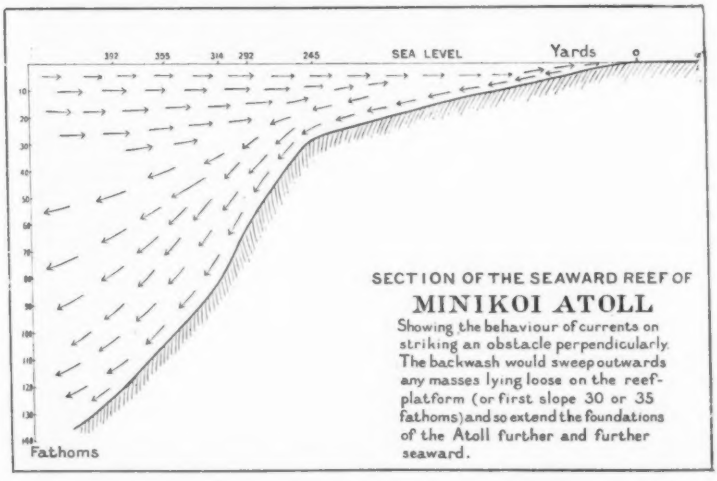
It may be contended, and perhaps truly, that the separate banks are the remains of some of the peaks; that Kolumadulu or Male perhaps were the sites of mountains, which were cut down 20, 40, or even 60 fathoms and then built up by the reef-organisms to their present level. This does not seem to me probable, on account of the great regularity

LAGOON BEACH, SHOWING WASHING AWAY OF THE LAND IN FALLEN COCONUTS AND OTHER TIMBER.

of the common plateau. Under such circumstances, its central part should have a much more definite basin-like form, with traces of the central valley. The channels between the banks would not necessarily but probably be shallower than the central part of the basin. There are further reasons in respect to the formation of the lagoons and their subsequent changes, which would make such a supposition appear to me highly improbable. Yet at the same time it is quite reasonable to suppose that the banks commenced to grow up before the plateau attained its present depth. The washing away would naturally be

slower with the deepening of any bank, but the upward growth of reefs at any points would tend by providing obstructions to accelerate it. The extremely hard bottom, found by our soundings, can only be explained on the view that the bank is still current-swept. The considerably greater depth in the channels as compared with the centre of the plateau must, I consider, be explained on the same view. There is no means of estimating this additional washing away since the banks commenced to grow up, but it may perhaps be safe to provisionally take the lesser depths found, about 160 fathoms, as the depth of our original plateau.

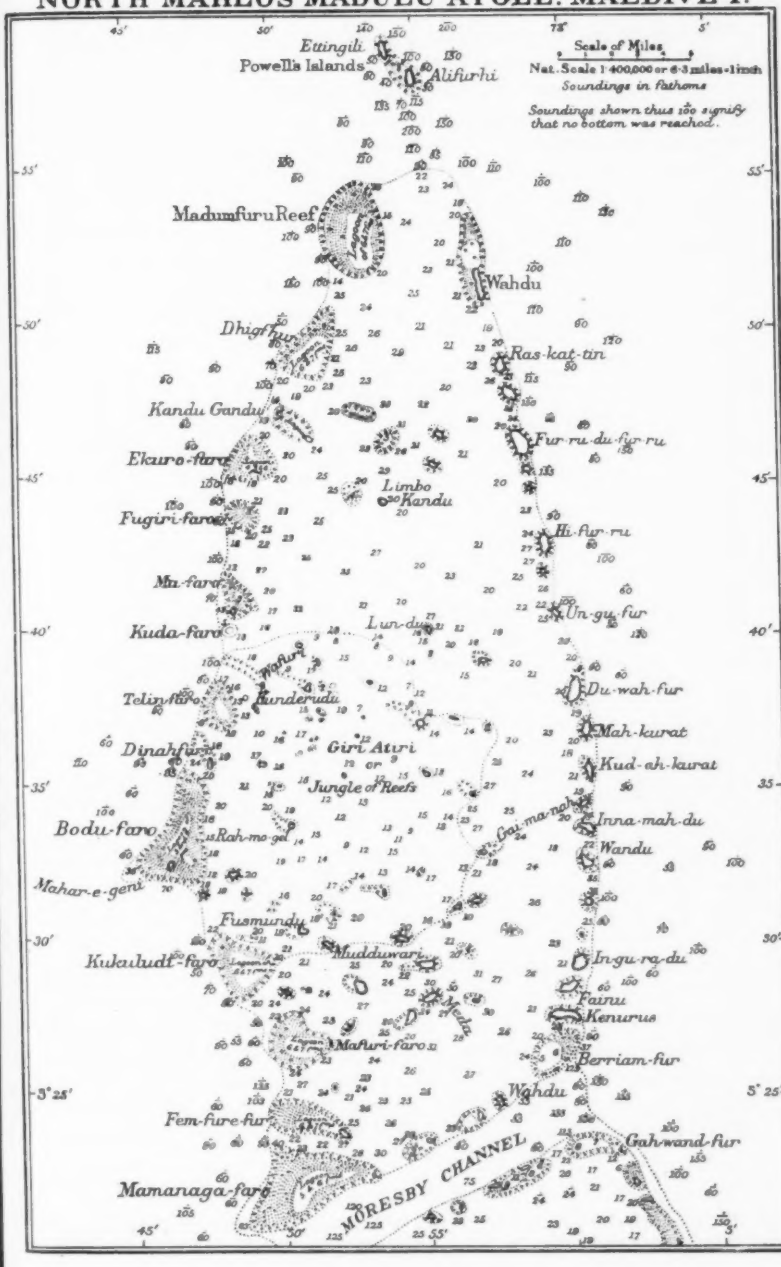
I conclude, then, that an almost flat plateau at a depth of 160 fathoms was at one time formed, and that on this the banks arose severally.



SECTION OF THE SEAWARD REEF OF
MINIKOI ATOLL
Showing the behaviour of currents on striking an obstacle perpendicularly. The backwash would sweep outwards any masses lying loose on the reef-platform (or first slope 30 or 35 fathoms) and so extend the foundations of the Atoll further and further seaward.

So far as sections have been run off atolls in the Pacific and Indian oceans, there is in all a striking uniformity in slope, a gradual fall to something under 50 fathoms, succeeded by a steeper drop to about 150 fathoms. The agreement in depth with our Maldive plateau suggests that this is the depth to which the currents have sufficient force to cut down the land and prevent the growth of reef-building organisms. Below this depth we have, I believe, the volcanic or inorganically formed basis of our banks. This was, of course, suggested in the first place by Sir John Murray, and in commenting on it Sir A. Geikie postulated that this depth "is probably nearly coincident with the lower limits of reef-builders." Neither, however, imagined depths approaching 150 fathoms, but with increase of knowledge the depth at which reef-builders may live has gradually been further and further increased. It has been pointed out that the reefs are formed

NORTH MAHLOS MADULU ATOLL. MALDIVE Is.



very largely by calcareous algæ (nullipores), and that reef-corals feed mainly by their commensal algæ.* The limit in depth at which these may live is a physical question depending on the power of sunlight to penetrate sea-water. There are no absolute experiments which bear directly on this point, but the results of dredging point to a depth of 150 to 200 fathoms as the effective limit at which the nullipores can live. The reef-corals do not extend so deep, but other corals might well have been important contributory, or indeed the chief agencies in building up the several banks, as Mr. T. Y. Buchanan has shown.†

In reference to this same question, I may guard myself against a slight, a possible misconception. When I point to the change from the steep to the more gradual slope of the basal mass, I do not assume that the whole of the mountain below this is absolutely built up of inorganically formed rock. When the reef once reaches the surface, it spreads outwards on every side like the ever-growing fairy ring. The current sweeps back from the first slope, and drops any loose masses it may find over the wall outside. More and more of the bank or mountain reaches the limit of depth of the reef-builders, and these, assisted by sand and any masses from the reef above, which they may catch, build up, as it were, course after course, and so thicken our wall.

Returning from the theory of the formation of the banks to the actual changes taking place in respect to their reefs, attention may be called to a few which throw light on the question of atoll-formation. Each bank perhaps serves to illustrate best some particular point, but so far as possible I shall draw my illustrations from the north part of Mahlosmadulu. This bank is divided by two narrow channels of 125 and 110 fathoms into three parts. Each part is studded all over its surface with reefs, some with land. There are no definite circumscribing lines of reef, but the areas of the three banks are marked out by series of isolated patches. These on the east and south sides of the whole bank are small and usually crowned with land, while those on the west are ring-shaped—indeed, small atolls or *faro*, with relatively deep water in the centre and little or no land on their reefs.

The islands are formed either of rock or sand. The latter is the ordinary material which washes over the reef, piled up by the waves. It is formed largely of coral and nullipore fragments, with pelagic foraminifera, broken shells of Mollusca and Echinoderma, leaves of Halimeda and similar algæ, with small pieces of pumice and a certain quantity of drift organic material. The rock is formed of corals, nullipores, possibly *Polytrema*, and sand. Coral predominates, but is here and there overlaid by incrusting *Lithothamnion;* the sand merely fills in

* *Vide* "The Building of Atolls," by J. Stanley Gardiner, *Proceedings International Congress of Zoology, Cambridge*, p. 119 (1898).

† "On Oceanic Shoals discovered in the s.s. *Dacia* in October, 1883," *Proceedings of Royal Society, Edinburgh*, vol. xiii. p. 428 (1885).

the crevices and hollows. The surface of the rocky area is covered with loose coral masses, but when these are removed, a layer of solid coral-rock is reached, usually about the high-tide level.

The central islands of Mahlos are formed generally of sand, but those on the rim have definite rock and sand areas. Whatever part of the rim-island lies within 300 yards of the outer, the seaward edge of the reef, is of rock, and the rest of sand. There is nothing to show clearly whether the sand areas were built up entirely by the waves, or partially owe their origin to other causes; they certainly are increasing in extent, wherever the rock affords protection from the heaviest seas. The rock is everywhere between tide-marks washing away, partially by

EAST POINT OF MALE ISLAND. TO THE RIGHT IS SEEN THE ROCKY POINT OF THE LAND WITH THE WAVES BREAKING OFF IT, AND TO THE LEFT THE REEF-FLAT. IN THE FOREGROUND THE LINES OF RAISED LIMESTONE SHOW THE FORMER EXTENSION OF THE LAND.

solution and partially by the wear and tear of the waves, acting on it when already weakened by boring organisms. The reefs to seaward of the rim-islands are, for some distance from the land, studded with masses of the rock, which form pinnacles or negro-heads. The softer parts of the rock are naturally removed first, and the harder constituents, the corals, remain. The latter can commonly be seen to lie absolutely in the position in which they grew. They cannot live above the lower limit of the tide, and hence the rocky land must have been formed by some alteration in level of the original reefs in respect to the sea. A few pinnacles stand up for 10 feet above the reef-flat, which is at the lower limit of the tide, and some parts of the rocky area of the land are

3 or 4 feet higher. Allowing nothing for the denuding action of rain, which must have been far from inconsiderable, a change of level of 13 or 14 feet is proved. It is not a great change, but it is extremely important, as it seems to extend not only through the Maldives, but over the whole Pacific ocean as well. Indeed, most of the land of coral reefs in these regions is explicable only on such a change of level. No definite cause for this can be assigned. It is not, I think, to be found by postulating an actual elevation, but rather by studying the formation of the neighbouring land-masses in the past, which must by their attraction have profoundly affected the level of the ocean in their vicinity, together with the two polar and other more complex conditions.

My next point bears reference to the actual growth of the reefs. It is not, so far as I am aware, disputed that an atoll-reef in an area of stable equilibrium will grow outwards, *i.e.* seawards, on all sides. It cannot be doubted that this is what is really happening on all the rim reefs of Mahlos bank. Masses are growing up outside the edges of the reefs, to be joined to them by further growth. Hollows are filled in by fragments and sand, and are bridged over by nullipore growths. To some extent the same is taking place in the passages which lead into the interior of the same bank. Their narrowest points are towards the sea, and inside between the reef-patches they gradually widen out like corrals. This is the case on both the east and west sides of North Mahlos, and points to a tendency on behalf of the isolated reefs to consolidate into long, narrow, linear reefs. With limited time, hands, and means, and with only small-scale charts, it was impossible to sound the passages so as to get any comparative results with Moresby's survey. The existence, however, of ten definite shoal patches in the passages into Mahlos shows sufficiently well what is going on. By dredging, colonial corals, nullipores, and *Polytrema* were brought up in the passages alone, save in the immediate proximity of reefs. The discovery, too, of shoals in many apparently well-surveyed passages of other banks in the Maldives leaves little doubt but that there is an upward tendency of growth around the circumference of Mahlos bank as well.

The inner or lagoon side of the same rim reefs of Mahlos bears a striking contrast to the seaward. The consolidating action of nullipores may be practically neglected, the reef being formed mainly of corals. There is no definite reef-flat. The slope to within 5 fathoms of the general level of the whole bank is almost precipitous and devoid of sedentary forms of life. The lower 5 fathoms is more gentle, the bottom covered with dead coral masses, with an occasional living colony of *Dendrophyllia* and *Madrepora*. There is nothing to indicate the further broadening of the reefs by direct organic growth save in a few peculiarly open situations. There might conceivably be a broadening anywhere by the piling up of coral masses from the reef above

at the edge of the steep, but of this action we saw no traces. It is doubtful, in the first place, whether loose masses would rest at such an angle as found in the steep, and our dredgings over the whole group gave this view no support. The dead coral which was dredged was generally rotten from the action of sponges, algæ, polychaets, sipunculids, and other boring organisms. It was neither coated nor otherwise protected by organisms, and seemed, indeed, to be rapidly breaking down. These same characters were found on the lagoon sides of all the reefs which can be said to have a lagoon, of all the larger banks of the group, at the passages passing gradually into the seaward conditions. They are more marked in those banks such as Suvadiva, with more perfect rims. They are well defined in the maze

LINE OF RAISED ROCKS, WITH A FEW TREES GROWING ON THEM, TO THE SOUTH OF MUDDUWARI, NORTH MAHLOS ATOLL.

of reefs in the centre of North Mahlos; but are, however, somewhat obliterated off the east rim reefs, owing to the washing over of sand from the land, and off the west reefs are not so marked as in more perfect atolls. In Miladumadulu they are still less clear, and off some reefs are not found, the characters approaching those of the seaward sides. There is abundant evidence in pinnacles on the reefs, lines of sand-rock, fallen timber, and in the disappearance of islands charted by Moresby, that all land in the interior of North Mahlos is washing away. The reefs where conditions such as shown above exist must, I consider, be going as well, the final result, together with the joining up of the rim reefs, being a perfect atoll.

Together with the washing away of the land, fresh conditions tend to be found on its reefs. The washing away of the latter is an extremely slow process, and does not commence to any important extent until the whole bank has begun to assume the atoll-form. Even then, should there be a relatively small circulation of water over the reefs of the atoll, as, for instance, in Addu, there may be, on the contrary, no loss in the lagoon reefs, and they may rather materially assist in filling up the lagoon. On the other hand, where the bank is open, the conditions

may remain favourable for the reef-builders, and the reefs may continue to grow outwards in a somewhat similar manner to the seaward reefs of the rim. The washing away of the land is, in any case, a much more rapid process than that of the reef. Limbo-Kandu shows the earliest stage. It was at one time presumably a reef on the Mahlos bank, with its summit awash, hollowed out to a depth of, at least, 4 feet in the centre. Its level, by the general change through the Maldives, was raised at least 13 or 14 feet. The walls of the island would then have presented a precipitous slope to about 20 fathoms. The land began to be washed away, with the result that a flat 30 to 40 yards broad was formed round the island. The reef too, doubtless by slight outward growth, assisted in forming this flat. This is the condition of the reef now, and the flat off most sides is well marked. The erosion continues, and in the next stage a sandy channel is found to have been cleared out within the flat to a depth of 3 or 4 feet, as at Meda, Cunderudu, Mudduwari, and off many of the east rim-islands. The washing away would not, perhaps, take place evenly on all sides, and the reef might be further distant in one place than another. The further the reef from the land the greater the hollowing out, with the result that the channel may be termed a lagoon. This is seen in many of the reefs, but it cannot usually be traced to be directly due to this cause. The original island of Fusmundu, however, may be clearly marked off over the greater part of its reef. The western three-quarters of that island have been completely washed away, such land as remains lying on the east rim of the reef. The former channel has become a small lagoon with 2 or 3 fathoms of water.

Almost in the same stage is the state found in Wahdu, Kandu-Gandu, and Wafaro, where islands exist on each end of the reefs, the central parts being hollowed out to form lagoons. In such cases, one or both of the ends of the original islands being formed of rock, its or their erosion would be much less rapid. In most of the west reefs the conditions have reached a further step, the lagoons being hollowed out to a greater depth, and the original islands being lost. They are, hence, definite atoll-banks. A few have pinnacles of rock showing the position of the former land-masses. Others have sandy islands, some of which were, perchance, parts of the original elevated land-masses, but give no decisive evidence as to their formation. Most have no trace left of land, but the conditions which lead to the formation of an atoll by the hollowing out of the reef are the same whether that reef was originally crowned with land or not. The size depends on the outward growth of the reef, the hollowing out being proportional to this. The conditions on the west of Mahlos, towards the interior of the bank, cannot in the past have been far different to those on the rim of any bank freely exposed to the sea, and must have been always much more

favourable than on the east, where the bank is protected by Miladumadulu and Fadifolu banks. As the reefs increased in size, closing in the bank, the conditions only would approach those in the interior of a definite atoll; in effect the erosion of the reefs, as sketched on Mahlos bank at the present day, would only begin to be found.

The comparison of the west atollons or *faro* of north Mahlos, as found by me, with Moresby's chart of 1836 yielded results of considerable interest. It showed that Dinafaro and Wafaro have now definite basins, while the lagoons of all the rest have increased both in size and depth. The original charts of Moresby are of small scale, and it is

LAGOON BEACH OF AN ISLAND, WITH A FALLEN COCONUT, SHOWING THE EXPOSED ROOTS OF THE TREES AND EROSION OF THE LAND.

difficult to appreciate the value of the comparison. The old survey bears internal evidence of its having been a most careful one, and I consider that the differences found in 1836 and 1899 are to a very large extent real. Even if this be so only to a limited degree, this comparison alone yields absolute examples and proof of one mode of formation of atolls from small surface reefs, *i.e.* by the outward growth of such reefs and the solution of their central parts.

Bodu Faro exemplifies one more point of which I have found many other undoubted examples, though not in north Mahlos. The merest glance at Moresby's chart shows that the reefs of these western atollons are broader towards the sea and narrower towards the centre of the bank. This at the present day is even more strikingly the case than shown by Moresby; but, of course, the difficulty of comparison with a small-scale chart is in this further intensified. However, Bodu Faro

gives definite evidence. Its depth now is 13 fathoms instead of 7 or 8 fathoms. Moresby's survey has three soundings—18, 15, and 18 fathoms—close to the east reef, which is represented of considerable breadth. The depth of the lagoon being given, one of the surveyors must have entered across the reef; but even the veriest tyro, making the above soundings, could see the character of the reef. It was presumably, then, in 1836 a broad surface reef, while in 1899 I found it to be opposite the above soundings, covered with 2 to 6 fathoms of water, and quite narrow. There is evidence here of the lagoon part of the reef washing away, the result being, together with the growing together of the rim reefs, to form a long narrow linear circumscribing reef.

I think that from the above alone it will be conceded that the expedition has justified its existence. It has shown that the banks of the Maldives arise on a common plateau at a depth of about 190 fathoms. The land has been undoubtedly, by some means or other, raised above the sea, and is now everywhere on the larger banks being washed away. The atoll-reefs are growing outwards on all sides, while their lagoons are increasing in area, and probably also in depth. The atolls owe their existence to the fusion of reefs lying on the circumferences of banks, together with the washing away of the reefs in the interiors of the same banks as their circumscribing reefs became more perfect. In general, the results of the expedition are in striking agreement with the conclusions drawn by Sir John Murray as to the formation of atoll reefs; but I should hesitate to apply these views to all coral-reef areas in the present state of our knowledge, to the exclusion of the subsidence or any other hypothesis.

Before the reading of the paper, the CHAIRMAN, Colonel Sir T. H. HOLDICH, Vice-President, said: In the absence of the President, I have the pleasure to tell you that despatches have lately been received from Captain Scott of the *Discovery*. These despatches are in every way most satisfactory, and the gist of them, together with further information about the expedition, will be given at the second meeting in February. I will not detain you longer, and I will now ask Mr. Stanley Gardiner to read his paper.

After the reading of the paper, the following discussion took place:—

Admiral Sir W. J. L. WHARTON: An intricate and complex subject like the formation of reefs, which has formed a subject of discussion for so many years, can only be solved, if it ever can be solved, by very hard and patient work. And we may congratulate ourselves, and I hope I may be allowed to congratulate Mr. Gardiner, on the admirable way in which the author has set himself to this task. He has devoted a great deal of time, he has risked his health, and done a great deal to furnish material not only for this night's discussion, but for many nights' discussion. He has set before us in a most admirable manner the conditions in the Maldives, and he has given us his own ideas on the way in which they were formed. I do not suppose any of us will accept exactly his propositions; it is too vast a subject to be summarized, but he is quite right to have attempted to summarize it, because

it forms a very good subject of discussion. There is one point I think I ought to mention. I do not quite think that Mr. Gardiner can rely so implicitly as he does upon the exact accuracy of the shape of these little atollons in the Maldives as they were mapped by Captain Moresby. If you come to think of it, this long line of islands extends for nearly 500 miles in a double line and over considerable width, and was mapped during three seasons in a small sailing vessel, and it is quite impossible—I know what the system of surveying of that day was—is quite impossible that the reefs could have been more than very, very roughly sketched; and while not at all disputing the evidence that he has brought forward that some of the reefs have changed in their width and in their depth, too much weight must not be put upon that unless the evidence can be very much accumulated. I should very much doubt whether the boats went into those entrances at all. In a great many cases it is noted down in the original surveys, "depth given by the natives," "depth reported," and so on. This has been left out in the published chart to simplify matters. But when we hear that the depth is 5 or 6 fathoms now, and it was only 3 or 4 sixty years ago, we must take it with a little suspicion. I should like to know, and Mr. Gardiner perhaps can tell us presently, whether any of the atollons are smaller. I understood him to say that the majority of the lagoons were widening out, and I should like to know whether the lecturer noticed any that were filling up. I must confess it is a little startling to me to find the changes that Mr. Gardiner supposes to have taken place, because they are very vast; they are very large indeed. The changes in the depths of some of the lagoons there amount to as much as 30 or 40 feet. I think Mr. Gardiner mentioned as much as 40 or 50 feet in sixty years. That is an enormous change. I refer to the southern islands, where he showed us the lagoons have been filled up so much; and then in the others in some cases there has been solution. I should also like to ask Mr. Gardiner whether in any case there are any islands now on the reefs where in Captain Moresby's chart there are no islands marked, so as to know whether the evidence is all one way. There is another point Mr. Gardiner, in what he gave us, has not mentioned; it is referred to in the written paper, but he did not mention about the formation of the atollons, and it is a very remarkable thing about the formation of these small Faros that they are not found anywhere else in the world, except on the western side of the Maldives and a few cases in the Louisade archipelago. It is a most interesting subject for consideration. Perhaps Sir John Murray will be able to give us some ideas on that presently. I do not know that I shall keep the audience any longer with my remarks. I only wish again to congratulate Mr. Gardiner on the vast amount of information he has collected.

Sir JOHN MURRAY: With the general summary with which the lecturer concluded his address, I have every reason personally to be satisfied. I entirely agree with him in his views as to how the present condition of affairs have been brought about, and I certainly must congratulate the lecturer upon the excellent way in which he has placed his results before this audience, and the still more excellent work he has done in the field. I do not think anything could more tend to place this country in the front rank of scientific investigation than the sending out of such men as Mr. Gardiner and his colleagues, men who have been trained in the work of scientific investigation, into the open field to do the work of surveying. He has done it well, and I am sure we are all glad to see him back again in apparently such good health. I still think that the probabilities are altogether in favour of that base being of volcanic origin. At the present moment Mr. Alexander Agassiz is working in this group with certain apparatus which will enable him to work at greater depth than Mr. Gardiner. If he collects specimens of manganese in any

form on the steep slopes of these islands, then I should say that is strong presumptive evidence that the foundations are composed of volcanic material. If, however, he should meet with some quartz glauconite and other like minerals, then I shall say the evidence will be entirely in favour of the view Mr. Gardiner has put forth. With respect to the manner in which these reefs grow up, I think Mr. Gardiner's theory by far the most plausible according to the present state of our knowledge, and with almost all he has said I cordially agree.

Lord STANMORE: My connection with the Maldives has been a political, not a scientific one, and therefore one which is far less interesting and far less important in this hall. But yet, as having had to deal with and settle various Maldivian revolutions, I may perhaps be allowed to congratulate Mr. Gardiner upon the manifest thoroughness of the work which he has done, and of the value of the results, and to express my own deep regret that it was not in the time when I could have had the opportunity of extending to him any facilities that it was in my power to afford him or to help him on his way in his work. I am not a scientific man; all that I can claim is that occasionally I look about me, and I have looked about me at coral islands in many parts of the world, and though it is not for me to express any opinion, and I shall not express any opinion as to their formation, this much I think I may say, and I think Mr. Gardiner will not dissent from it—that without making any theories on the subject, it is necessary to take into account the very various physical conditions of the different localities in which these coral formations are to be found. I mean that in some places where you have extensive coral formation you have the most active and violent volcanic agency still in force, still active: in others, that action if it ever existed is absolutely dead, and you cannot expect, I think, to find exactly the same state of things where you have two such totally different conditions of physical existence. I dare say Sir John Murray knows quite well, but I remember being very much struck on seeing in one of the remote islands of the Seychelles, Frigate island, a manifest coral reef forming a complete lagoon on the top of an igneous rock some 200 feet above the level of the sea.

Sir JOHN MURRAY: Quite common.

Lord STANMORE: But my object in rising was not to give a lecture on a subject on which I am quite incompetent to give one, but to express my sense of the value of Mr. Gardiner's work, and my own hearty appreciation of it.

Dr. W. T. BLANFORD: I can only add my meed to that of those who have spoken of the admirable piece of work that Mr. Gardiner has effected. For a great number of years, all those who take any interest in oceanography and in coral islands have been most anxious to obtain further details about the Maldives. They are in many respects a singularly interesting group of atolls, and especially in one point on which considerable stress has been laid, and that is the great depth of the lagoons within the atolls. I believe the case is almost unprecedented of lagoons being 40 or 50 fathoms in depth in other coral islands. It is possible that we should do better, before expressing any opinion as to the results, to wait until these are published in full detail. We are not sufficiently acquainted with what has been done by Mr. Gardiner from simply hearing the short account that he has given us this evening to express a very definite opinion. But still there are one or two points in which I cannot quite agree with the conclusions formed, and I think it is only right I should mention them. In the first place, the theory for which I think Sir John Murray is responsible, of the origin of lagoons by solution, has always appeared to me one of extreme difficulty. The most important evidence in favour of it which has been brought forward by Mr. Gardiner has been shown by Sir William Wharton to be open to some little doubt, and I would specially point out that the evidence is contradictory, because if some of the atolls in the northern

islands have increased in depth, the atoll in the most southern island appears to have diminished. But that is not the only point about this atoll. I do not know whether it will be within the recollection of those who saw the representation of Addu atoll upon the screen, that the inlets through which the water enters are all very much shallower than the lagoon. Now I venture to suggest that, if the depth of the lagoon is due to solution, the deepest part ought to be the inlets.

Sir JOHN MURRAY: Not at all.

Dr. BLANFORD: Surely water in rapid motion is more effective than water comparatively at rest?

Sir JOHN MURRAY: Not at all; an inch of water will only take up the same amount of lime.

Dr. BLANFORD: In general, water dissolves more when it is in motion.

Sir JOHN MURRAY: A cubic inch of water will take up the same amount of lime whether it is at rest or whether it is in motion.

Dr. BLANFORD: At any rate, a greater quantity of water passes over the surface. I must say there appears to me to be a difficulty in this way. It is certainly a wonderful thing if water has dissolved the rock to 30, 40, or even 50 fathoms in depth. Then, another part of that theory of the formation of the atolls which was brought forward by Mr. Gardiner also appears to me to be in need of further evidence. Let the rock forming the bank on which the Maldives stand be what you please—it may be volcanic, or it may be granitic or even sedimentary—I do not think we are justified in believing that any oceanic current can cut down a bank to a depth of 200 fathoms. Formerly we were under the impression that at the outside 8 or 10 fathoms was the depth to which water would cut down rock; but I believe it has been shown that waves are effective to a greater depth. Some effect may be produced to a depth of 30 or 40 fathoms, but beyond that it is very difficult to understand how erosion takes place. Erosion is produced by the action of solid particles moved by the water. I would therefore suggest that, instead of the bank having been actually formed at a depth of 200 fathoms below the sea, it was probably formed very much nearer the surface, and that it has sunk, producing precisely the conditions on which Darwin's theory of the formation of coral islands proceeds. Then I think it is also more than one is fairly justified in doing to suppose that the deep-sea corals are capable of building up massive reefs. The great reef-building corals are only known to exist near the surface. These are points of difficulty. On the other hand, I must say it is exceedingly satisfactory to hear that Mr. Gardiner is inclined to agree with those who have paid particular attention to the geology of India, in believing that there was at one time land union between India and South Africa. One point I might mention is that the only high islands that occur in connection with the great line of scattered atolls which appear to unite India and Africa are the Seychelles, which are formed of gneissic rock. There is one more point I should like to call attention to—the very interesting photographs of the natives of the Maldives that were shown to us at the commencement of the lecture. Some of the faces appear to me to have a considerable resemblance, so far as one can judge from the physiognomy, to some of the aboriginal hill tribes of India. It may be remembered that Prof. Huxley, I think, pointed out the extraordinary similarity between some of these people and the aborigines in Australia. It is by no means impossible that the same race may be found amongst the primitive inhabitants of the Maldives. I can only say, in conclusion, that I listened with a great deal of pleasure to the most instructive lecture Mr. Gardiner has given us.

Mr. GARDINER: I should like to thank the various speakers for the very kind words in which they have referred to my paper. I would in particular express my

gratitude to the first two speakers, Admiral Wharton and Sir John Murray, for their great kindness to me and for the practical assistance and advice that they gave me in drawing up the route of this expedition. I would also like to express my indebtedness to Sir Edward Walker for his kindness to me when he was acting-governor of Ceylon. I do not think that there are many points that it is necessary for me to refer to. With regard to Admiral Wharton's question of the reliance placed on Moresby's chart, I showed the changes compared with Moresby's charts, but I do not personally believe in such very great changes as one saw there. I believe, however, there has been change. I consider that it is impossible for Moresby to have made such great errors as would be required, were there not really some changes in the direction of the clearing out of the lagoons of the faro to the west of Mahlos atoll. There is the same change right throughout the lagoons. I have not found a single lagoon of any faro that seems to be filling up. I quite agree with Dr. Blanford in saying that the full account of the group is really required before discussing the subject of this paper. I hope that it will be published shortly. With regard to Dr. Blanford's reference to the solution in lagoons, Dr. Blanford has, I believe, asked one particular question which also bears reference to his remarks to-night. Why it is that some of the reefs wash away and some reefs do not? Why it is that the outer reefs of the atolls are not dissolved, and that the reefs in the lagoons are dissolved? I might point out to Dr. Blanford that where the water is in motion the basal reef is protected by growing organisms. According to my observation, solution cannot take place through these growing organisms, and it is for that reason that I consider that the passages of lagoons are not being deepened, that there is no solution practically going on in the passages into the lagoon banks, and that there is no noticeable solvent action on the seaward sides of the encircling reefs of atolls.

Dr. Blanford: My remark applied to the inlets.

Mr. Gardiner: The bottom of any passage is covered with living organisms, so that it would apply to that equally with the outer reefs. Where the water is in motion the organisms dwell. With reference to the effect of currents, we managed to take the direction of the great monsoon currents by means of an indicator, a compass which could be thrown out of gear by means of a messenger. We managed with this to record the direction of currents down to 150 fathoms. The surface current was in places travelling in one direction, the under currents were running in the opposite direction, yet time after time the compass came up showing always the same direction at any particular depth. It seems, then, with a rough direction-indicator one can measure down to 150 fathoms, and I think the currents may well extend to a much greater depth. I should point out, too, that in Mr. Buchanan's observations near the Canary islands, the effect of the currents was noticeable down to 1200 feet. With regard to the building up of reefs, I would also refer to Mr. Buchanan's account of numerous shoal-patches in the Atlantic ocean. Some of these are within 50 fathoms of the surface, and Mr. Buchanan laid particular stress on the fact that they must have been formed entirely by means of the deep-sea corals. Now, in reference to these same corals, I quite agree with Sir John Murray that on the face of a reef is the most vigorous coral growth; but so far as corals are concerned, most, practically all those which may be called reef-builders, I believe obtain their food by means of their algæ, and that on the face of the reef there is the more vigorous growth because the motion of the water brings fresh carbonic acid gas to them continually. Of course this is a question which is entirely *sub judice*, and I have not made enough observations to speak definitely on it; I only say what my belief is, and that my experience differs rather from his. I may refer for an instant to the natives of the group. What

race they roughly belong to seems to be a very mixed question. I know nothing about their measurements myself, but I am informed that they seem to differ practically from any race at all that Mr. Duckworth has had anything to do with. They are a very intelligent people, an extremely quiet people, and I may mention that there is one name which is particularly well known throughout the Maldives—that of the third speaker who spoke to-night, Lord Stanmore, who was then known as Sir Arthur Gordon. They continually asked me about him. In conclusion, I would thank you all, Mr. President, and ladies and gentlemen, for your kindness to me.

The CHAIRMAN: I fear that no words of mine could add much to the interest of the discussion this evening. Mr. Gardiner has taken us into regions which are probably as unfamiliar to most of you as they are to me, but you will agree that he has given us a most interesting and graphic description, not only of the conditions of life in those islands as they are at present, but he has given us some short insight also into the life-history of the islands themselves, their construction, and their disappearance. I am sure you will wish me to convey for you the hearty thanks of the meeting to Mr. Gardiner for his paper.

THE IMPORTANCE OF GEOGRAPHY IN EDUCATION.*

By the Right Hon. JAMES BRYCE, M.P.

WHEN my friend the chairman asked me to give you an address, I felt some diffidence in doing so, because I know that members of the Geographical Association are themselves persons for the most part possessing a practical acquaintance with the subject much greater than I could lay claim to, and I always feel that it is dangerous for an amateur to give an address to specialists. I consented, however, chiefly because the occasion gave me an opportunity of expressing the very warm interest which I feel in the work of your association, and my hearty sympathy with it. Nothing has been more wanted for a long time than that an association of this kind should exist for pressing upon the public a knowledge of what its real interests in geographical teaching are, and for that reason I very gladly consented to say what I had to say to you. I cannot hope to say anything novel to those who are familiar with the subject, but I may perhaps attempt to lay before you a few considerations which bear upon its wider aspects, and which are chiefly suggested by observations that have occurred to me in the course of travel in different parts of the world.

The place of geography in education may be considered under three aspects, and I will distinguish those three aspects by the shortest phrases I can find. Geography in one aspect or sense is the gateway to the physical sciences; in the second aspect it is the key to history; and in the third it is the basis of commerce. These three aspects in

* Address delivered at the Annual Meeting of the Geographical Association, January 15, 1902, with Mr. Douglas Freshfield, President, in the chair.

which it may be regarded correspond to the different parts of school, college, and university work, and they have to be carried out and conducted to some considerable extent by a different part of the educational staff of a school or college or university, and yet each of the three has very important relations to each of the others. This is especially true with regard to the first two, and yet the third is also in intimate relations to the two former. He who wishes to understand geography in any one of these three aspects ought to know something about it in the other two aspects; and he will find what he knows about it in any one of the aspects, of which the first is after all the most fundamental, will help him to comprehend and to apply his knowledge in the other two.

Let me begin with geography as what I have called the gateway of science. We may say that man touches nature, the external world of nature, in two points. First of all he touches it through the constitution of his own physical body. As possessing a body, he is himself part of nature, and he comes into relations with it through that body. The study of these relations belong to the sciences which we call physiology and biology. Then he also touches it in another way. He touches it through the external world, the phenomena of which he learns through his senses and in which he is placed to do his work. Geography may be described as being the general science of the Earth, perhaps I ought to say, of the Earth as a part of and affected by other parts of the material universe, but in the first instance, and for our more immediate purpose, of the Earth which we inhabit. Geography is the science which takes for its province the describing to us everything that relates to the Earth.

All branches of knowledge which have anything to tell us about the Earth more or less hinge into or are connected with geography, or you may, if you like, say they diverge from it as specialized departments of that general knowledge which it presents in its connection with the whole. For instance, geography takes account of the solid crust of the Earth. The solid crust of the Earth is the special subject of three sciences, geology, mineralogy, and palæontology, which therefore diverge from geography as being specialized branches of the science which it presents in a general way. Then you have a second divergent branch in meteorology and oceanology, dealing with the phenomena of the air and vapour and the closely cognate phenomena of the great masses of condensed vapour which exist on the surface of the Earth in the form of oceans. A third branch is that represented by the sciences of botany and zoology, describing the living creatures which find their home and their sustenance on the Earth. A fourth, a little more remote, consists of the sciences of physics and chemistry, which again deal with the constituents of the globe and of the forces which move them; the forces which you see in operation on the Earth belong to the science of physics,

and the study of the constituent elements of the Earth, the methods by which they are analyzed, and the combinations which they form belong to the science of chemistry. Even astronomy, although it carries us beyond the limits of our terrestrial globe, is really closely connected with the science of the Earth inasmuch as many terrestrial phenomena are sensibly affected by the phenomena which lie beyond the globe, and cannot be understood without a comprehension of astronomy.

The whole of this great group of physical sciences, each of them re-divided and specialized into numerous branches and departments, springs from geography as the centre of the group. Physical geography in particular shows the relation which each of these branches of science bears to the others, and the way in which all taken together have an influence upon the life and development of man. One may figure the thing by saying that geography is a sort of great central hall, from which there open out numerous doors leading into apartments, each of these being dedicated to some particular one of the sciences which are connected with the Earth and its phenomena. All the apartments find their meeting-point, their point of convergence, the place through which the student must pass from the one to the other, in the science of geography which stands in relation to them all alike (or almost alike). Therefore in this sense you may say that geography constitutes the approach to all the physical sciences. It is the science which brings them all into correlation with one another; it is the science through which you can best observe the action of each of them upon the life of man. Thus it holds a highly significant place in education. Students who are going to devote their attention mainly to the physical sciences find geography a starting-point; it indicates the relations of the sciences to one another, for all are connected with the external nature in the midst of which we stand.

Students who are not going to devote their attention to the natural sciences, but to what are called the human subjects—literature, history, philology, economics, and so forth—again find in geography the point in which these subjects have their contact with the physical sciences. If such students are given at the starting of their career a due comprehension of the numerous bearings and relations which geography has to all the other sciences that deal with physical phenomena, they are better able to specialize in those special human branches of study which they intend to pursue, having gathered the relation which they all, through geography, bear to physical science.

This is the first point in which I venture to think you may claim for your science an exceedingly important part in the general scheme of education. It gives the student a proper conception of the relation of the sciences of nature to the sciences of man, and it shows how the different sciences of nature are related to one another.

Further, geography, and more particularly physical geography, upon

its practical side, becomes of the greatest value as a training in the art of observation. Physical geography, like other kinds of geography, used to be taught mainly out of books, and the pupil was allowed to have very slight contact with facts which he can see for himself. Happily all that has been changed, and I am glad to know that now in this country, as has for some time past been the case in Germany, it is thoroughly realized by all progressive teachers that geography must be made as much as possible an experimental science—experimental in this sense, that the pupils' minds must be brought into contact with facts, and not words, that they must be taught to connect what they read and what they hear from their teachers with the actual facts they are trained to observe for themselves. All competent teachers of geography have now begun to feel that they ought to start out by giving the scholar a direct personal knowledge, and not a mere book knowledge, of the meaning of geographical terms and the elementary data of physical geography; that he ought to be taken round the place in which he lives; that he ought to be shown hills, or mountains, if he is fortunate enough to have mountains in his neighbourhood, and notice the rocks they are made of; that he ought to be taught to observe the course of rivers and brooks; that he ought to be led to study the inclinations of hills and the structure and features of an undulating country, or of plateaus, or of riverine plains; that he ought to be taught to observe the trees and the vegetation generally which appertain to particular kinds of soil, or to particular exposures; and to keep his eyes open and his memory alert to watch the winds and the rainfall, and to acquire a knowledge of the climate of the region in which he lives. All these things, about which he reads in his text-books of physical geography, ought to be made real and vital and full of meaning to him, by being connected with the actual facts, which he can note and remember when they are shown him, but which he probably will not notice unless they are pointed out to him. He lives among them, but he may never observe them (unless he is an exceptional boy) until his attention is called to them. Physical geography, communicated in that way by an active-minded and intelligent teacher, becomes one of the best possible of trainings in the art of observation, an art which might appear easy and natural, but which in reality requires a good deal of training, because no one knows, until some incident calls his attention to it, how many of the phenomena among which he moves he has failed to observe.

Thirdly, from observation the study of geography passes into the stage of reflection and combination, that is to say, these phenomena which have been made real to the pupil by his being taught to observe them, have to be suggested to him as subjects for inquiry and brought into a casual relation with one another in order that he may ask himself, What has been the source of these facts I see in external nature, and how

are they connected with one another? He must be taught, whenever he is shown a fact in physical geography, to inquire into the cause, and whenever there are two facts, to ask what relation, if any, there is between them. What connection, for instance, is there between the inclination of the hills, whether gentle or steep, in a mountainous district and the character of the rocks and amount of rainfall in that district? What connection is there between the growth of trees and the rainfall and the prevalent winds? In that way physical geography will teach the pupil to acquire the habit of looking at a region as a whole, so that when there is any district which he has got to know by his own observation, he will begin to reflect and seek to discover what have been the physical causes which have gone to make this district what it is, and what relation exists between those various causes.

It is extraordinary how little most of us will observe of these matters if we are left to ourselves. Ask yourselves how many people among your acquaintance there are who have any intelligent knowledge of the weather, that is to say, who are in the habit of observing the direction from which winds come, and the phenomena of the sky which indicate fair weather or dull weather or rain respectively? You will find, I think, they are extremely few. It is a rare thing to meet even a man living in the country who has made an intelligent study of the weather and who constantly observes the winds, who knows from what kind of wind and from what aspects of the sky certain weather may or may not be expected. Of course we all know that the predictions of the best weather prophets, even aided by barometers and reports from outlying signal stations, are uncertain. But, at the same time, there is a great difference between the man who can make a tolerable forecast of what sort of weather may be looked for on an afternoon fixed for a picnic, and the man who has no data at all for an opinion, but thinks, as so many people do, that it is going to be fine at 3 p.m., because the sun is shining at 9 o'clock in the morning. In the same way, it is odd how very few people there are who notice the vegetation of the district in which they dwell. One is often surprised to find how few persons among those who are in a general way observant and intelligent, have noticed that particular trees and particular plants and flowers grow upon particular kinds of soil, or under particular physical conditions. If you were to ask, for instance, one of your ordinary intelligent friends who live in the country if he could tell what plants are characteristic of chalk soils, or what kind of soil it is that any particular tree—let us say a fir or a beech—prefers, you would be surprised to find how few there are who could give you an intelligent and correct answer to such a question. Yet observation of this kind does not require any special botanical knowledge. There are persons who do not possess that special botanical knowledge, but could give those answers, but they are comparatively few. That is a third advantage, which I claim for the

study of geography as a gateway to science, that it may be made an admirable training, not only in observation, but also in reflection upon the phenomena lying all round us in external nature which we know from an observation that is within most people's reach.

Fourthly, the study of geography in this way adds immeasurably to the pleasure of travel. We all of us enjoy in increasing measure at the present time opportunities of travel by land and sea, and, for one person who crossed the Atlantic from the continent of Europe to the continent of America fifty years ago, I suppose there are at least twenty or thirty who cross now, while for one person who crossed the channel to France fifty years ago, there are a hundred now. How few people use adequately the opportunities for the observation of physical phenomena, or indeed for observation of any kind which travel gives, or who possess the amount of knowledge required to enable them to observe properly and to get the full enjoyment which travel is capable of yielding. There is no greater pleasure to be derived from travel than that of learning something about the country one is visiting. You cannot properly understand a country unless you have a knowledge of the fundamental facts of its physical geography, and have formed the habit of observing them. Without this, you cannot form a true conception of a country as a whole. Sometimes I have fancied it would be worth while to try and provide at one of our universities some systematic instruction in the kinds of knowledge and skill in observation which come chiefly into play in travel. There was a book written some thirty or forty years ago by a distinguished friend of yours and mine, Mr. Chairman, I mean Francis Galton, called 'The Art of Travel in Wild Countries,' which describes a great number of devices which the traveller will find useful in dealing with savage men and overcoming difficulties of wild nature. There is also another and very useful book of a similar kind called 'Hints to Travellers,' which has appeared since and gone through several editions. But perhaps there is still room for a book more comprehensive than either of these, and less scientific than the latter, more on the level of the unscientific mind, taking in some matters which do not belong to physical science at all. Such a book might suggest to travellers or tourists how to observe the relation of the rocks to the scenery, what the relation of the rocks is to the vegetation, what the relation of the climate to the vegetation, and how to estimate the productive capacity of a country, how to learn something about its races, about its antiquities, about its economic conditions, and about its languages or dialects. When one takes a long ocean voyage, one is surprised to find how small a number of persons there are on board who know anything of trade winds or monsoons or ocean currents, other than the now familiar, yet often not very well understood, Gulf Stream. Yet how much such a knowledge adds to the pleasure of travel. Such a book might be elementary enough to be fit for persons

possessing no special mastery either of science or of history. It would not replace either of the books I have referred to, but it might be useful to a somewhat wider public.

I now come to the second of the three aspects of geographical science —to geography regarded as the key to history. The conception of that relation has now become so familiar an idea that it is not necessary to go into it in any detail. Everybody has come to realize the important part which physical environment plays in the development of mankind, not only of mankind as a whole, but of every particular race of mankind, of every nation, and of every state. You have books like the new 'Universal History,' by Dr. Helmolt, which devote themselves to treating history from this point of view, and showing how it may be regarded as being the outcome of the physical environment in which man as a whole, and the different races and communities of man, have found themselves placed. This way of looking at history has only recently become common, and the fact is remarkable when one considers that the influence of nature upon man must have been present to the minds of reflective men from remote times. One finds isolated remarks on the subject even in the ancient philosophers and historians, so it is a little surprising that it is only quite recently, to the best of my recollection, that historians have begun to treat the physical phenomena of a country seriously and systematically as a very important element in the development of that country. Now, speaking from recollection, I think that Gibbon, for instance, makes few and scanty references to the physical phenomena of the regions over which his splendid survey of the passage from the Old World to the New led him. If one takes a still more brilliant ornament of the eighteenth century, Montesquieu, one of the most fertile and ingenious minds that ever approached historical inquiries, even he makes comparatively slight use of the relations of nature to man. You will, of course, in these and other great writers, find occasional remarks which show that the relation was not absent from their minds, but they do not seem to have grasped it as a whole or presented it with anything like the completeness with which a modern philosopher or historian would think it necessary, to explain the influence on man of his physical environment. One younger contemporary of Gibbon occurs to me who had ideas on the subject. I mean the traveller, Volney. In his book about America, which he visited shortly after the revolutionary war, he has made several rather striking remarks, which show that ideas of this kind were beginning to make their way. No doubt there are many other thinkers in whose works you will find indications of this way of looking at history; but it has been reserved for our own time to realize the extreme importance which environment possesses as an historical factor. And yet, after all, there was Herodotus. Herodotus, more than twenty-three centuries ago, was equally an historian and a geographer, although he did not bring the

two things into regular scientific connection, but any one can see that he was equally interested in both, and he was just as anxious to describe the physical conditions of the country as to give an account of its history and people.

We are now all agreed that geography is the foundation of history, and that the historian must know geography. It is perhaps not equally necessary that the geographer should know history. At the same time a geographer may gain a great deal by knowing something of history, and some branches of his subject will remain incomplete unless he possesses that knowledge. Without pursuing the subject into detail, it may serve to illustrate the proposition that geography is the key to history if I mention some branches of history upon which geography pours a direct and illuminating light. One of these, for instance, is ethnography. The whole study of the races of mankind and their connections with one another, and their mingling and blending with one another, and their passage from one part of the Earth's surface to another, evidently depends upon a knowledge of geography, and in particular of physical geography, because it is these physical conditions that have influenced the movements and blendings. So linguistic history, which is almost a branch of ethnography, is another subject on which the geographer can throw light. Or take the case of military history, itself a branch of political history, and consider how much physical geography has to tell the student of wars and campaigns about the importance of lines of communication, the significance of mountain ranges and rivers, the places available for fortification, whether by seas or rivers, or on hills. You will see at once that a knowledge of the physical geography of a country is essential to the man who studies military history in a scientific spirit. Then if you come to that large branch of history for which we have no satisfactory English name, it is what the Germans call Kulturgeschichte, the history of the social and economical progress of man, the history of the kind of culture which expresses itself in social life and artistic life, and the development of letters and learning and science—that branch again is, of course, intimately connected on many sides with the physical environments of the countries in which a civilization has been developed. You may find in such a book, for instance, as Mr. Payne's recently published 'History of the New World called America,' how the whole history of the aboriginal American peoples, and especially of those who early attained to a certain measure of civilization, can be treated most profitably in connection with the physical conditions under which they lived, and under which the latter outstripped their fellows. A particular branch of this subject, which illustrates very well what I mean, is the history of architecture. This history, which might seem to be comparatively far removed from physical geography, is intimately connected with it. One of the points in which it is connected is in the

rocks which furnish building-stones, and in the different character impressed upon the buildings in any district by the materials which are at the builder's disposal. Another side is climate. Climate has had an influence on architecture in determining the shape and covering of buildings, and also in determining the nature of the carving and exterior ornaments that it was worth while to put upon the buildings, because in some climates decorations soon perish, while in others they remain fresh and clear during many centuries. Further, of course, a very interesting side of the history of architecture is the history of the relation of the architecture of one people or political community to the architecture of another, and the influence which the architecture of one community has exercised upon that of another. I remember, for instance, how often the late Mr. Freeman used to insist on the importance of what he called the Burgundian type of architecture. It is one of the types which, until he made it familiar to us, had almost passed out of our minds, and yet it is perfectly true that one does find in certain districts on both sides of the Alps interesting traces of a common type, which become explicable when one remembers what the former political conditions of these countries were. When one begins to consider the former political conditions, one is naturally led to ask what were the physical causes under which they arose. Notice further that there is an extremely interesting aspect under which geography ought always to be studied in relation to history, and that is the change in relation of man to his environment between earlier and later times. This is a special point, which I will do no more than indicate, but you will see how interestingly it might be worked out. While man is still in his primitive stage, not yet civilized, he is in entirely different relation to natural conditions from that which he bears when he has invented arts and sciences, and when he has become master of the forces of nature. In his primitive state, defence against wild creatures and ease of procuring food were his great necessities, but in his more advanced stage it is the facility wherewith he can obtain a supply of those forces of nature which he can bend and use for his own purposes that becomes the most active agent in advancing his further progress.

There is also one aspect of the relations of geography and history which is of great importance, and that is the history of geographical discovery. We do not always, in our teaching of history, give quite enough importance to making the pupil realize the quantity of geographical knowledge which was possessed at different periods of the Earth's history by the various peoples who inhabited it. Many a young man may go through the university course having realized very imperfectly what was the amount of geographical knowledge that was possessed by the ancient world at different epochs, and similarly the steps by which geographical discoveries since the days of the Portuguese in the middle of the fifteenth century have been advanced. It adds much

to the interest of study, and it explains many of the phenomena of history, to make the pupil at every stage of his progress have a picture of the world as then known before his mind, and to realize where it was that darkness lay and on what points light had from time to time fallen during the long progress from the days of Homer to our own, in the discovery of the various continents and oceans of the world. For that purpose we want a greater number of historical maps in our atlases than we generally possess, and I am sure, on the walls of a college lecture-room, nothing could be more serviceable than to have these constantly displayed before the pupil. It may be that in the best historical schools this is now done. It was not so twenty or thirty years ago.

Lastly, the third aspect in which geography comes into education, or rather the third of the aspects that I am asking you to consider, for there are doubtless other aspects, is that in which it is regarded as the basis of commerce. Commerce, reduced to its simplest terms, is an exchange of products, and both the maker of any article and the exporter of that article ought to know where each article can best be produced, whence the raw materials used in manufacture come, which are the places best adapted for manufacture, and where are the best markets. To use the words of Virgil, the merchant ought to know *quid quaeque ferat regio et quid quaeque recuset*, what each country bears and what each country refuses to bear. He ought to know what are the conditions under which the product can be obtained, what are the conditions of labour that determine the getting of it and the transporting of it, what are the markets, whether near or distant, in which it may best be disposed of and where requirements affect its production, and what are the lines of communication and transport along which it can best (most swiftly and profitably) be carried, whether by sea or land.

This commercial side of geography has two aspects. It may be considered either as a question of the direct and immediate utility which it has for the manufacturer or the exporting merchant, or it may be considered as tending to aid in the general expansion of his views and his comprehension of the financial and commercial conditions of the world. Of course it is true that a manufacturer or an exporter will primarily rely upon the direct reports which he receives from his agents abroad. Every considerable manufacturer or exporter, as the case may be, will probably have an agent, or at any rate some adequate source of information, although, no doubt, our merchants have not yet done all they ought to do in providing themselves with such means of information concerning the different markets of the World, so that they may know whence they can best obtain their materials, and whither best send their manufactured products. Although it is chiefly upon these direct reports by trained observers on the spot that the merchant

will rely, he will comprehend the whole subject a great deal better if he has acquired a general mastery of the commercial geography of the world, if he knows the producing areas and the markets and the lines of transport as a whole. A great commercial man, whether he be a great manufacturer or whether he be a great exporter, can develop for himself certain lines of commercial action ; he can frame a large policy upon which he can conduct his operations. In the same way as a general would determine where to distribute his forces, so he will consider where he can best get the materials he wants and to what markets he ought to send them. His wider knowledge of the world as a whole will enable him to take not only a more intelligent, but a more practical and serviceable view of what ought in each particular case to be attempted. His policy will of course frequently need to be varied. It will never do for a man holding so important a position to rely upon what he has learnt years before, because the conditions are constantly changing. What is needed is that he should have a due conception of the magnitude and complexity of the subject, and of the proper methods that must be brought to the study of them. In this way geography may be said to become a branch of, or a sister science with, economic science.

I have felt for many years, and indeed have taken many occasions of urging, that modern commerce, whether it be regarded as an exchange of commodities, or be studied from the side of production or the side of finance, has now become a subject which ought to receive full university recognition. It is a subject which is quite worthy of being treated in a philosophical and scientific way, and of having a place in the curricula of all our universities. That was recognized some little time ago at Liverpool. The University College there started some classes on a small scale, but still with the due appreciation of the principle I have been endeavouring to set forth. Those classes are giving young commercial men an education in what might be called commercial science. I believe the same thing is being done, or going to be done, at Birmingham, and probably elsewhere. It is most satisfactory to know that geography in its relation to economics is now receiving great attention at the London School of Economics, which has now become one of the schools of the new teaching University of London. I learn from the director of the School that these classes are well attended, and that recognition is being given by the university authorities to geography not only in connection with physical science,* but also in connection with economics and history.

The aspects in which I have been endeavouring to regard the teaching of geography are perhaps rather fitter for a university or for

* This is a mistake. Geography is not recognized except in the Faculty of Economics. Of course certain aspects of physical geography are required in geology, but that is very different from a full recognition of geography as a science.—*Editor.*

advanced scholars than they are for a school. At the same time much may be done even in school for pupils between the ages of fourteen and sixteen. There is all the difference in the world between being "elementary" and being "superficial." I would not suggest that schools should deal with the subject if only a superficial treatment could be given to it, but I believe that even elementary knowledge may be made profitable, provided that it is always given in close connection with facts which the pupil can be taught to observe for himself and to reflect on for himself, and not as a mere string of data to be carried in the memory. Let us, however, remember in all these discussions about commercial teaching, that neither it nor any other professional subject must be suffered to interfere with the giving of a general stimulative liberal education. Of course the more you can teach in school, so long as pupils thoroughly understand it, the better; but you cannot specialize to any great extent with boys who are going to leave school at the age of fifteen or sixteen. It is necessary to lift up one's voice against that. But when you deal with young men who are going to remain at a higher secondary school till they are seventeen or eighteen, or are studying at the university, you are dealing with a class from whom will be drawn the upper officers and the what may be called general staff of the army of industry, and you cannot give too much pains and thought to enlarging their views of professional branches of instruction, and giving them an intelligent conception of the phenomena with which they will be concerned in their business life. A large part of those deficiencies in the scientific commercial aptitudes of business men which we hear commented on, springs from the disregard of the needs of those who are going to step into the position of the heads of leading firms. You can hardly overrate the importance in the conduct of any large business, be it a manufacturing or be it a mercantile house, of the possession of a wide and intelligent knowledge of the financial and economic phenomena of the modern World. If you have at the head of the great businesses, of which there are so many in this country, men who have been thoroughly trained to observe these things and to look at them in a scientific way, you will have done a great deal towards helping us to maintain our place among the commercial nations of the World.

I had thought over a number of hints that might be given about methods useful in geographical teaching, but I have come to the conclusion, especially since reading your excellent organ, the *Geographical Teacher*, that it is not likely I should be able to say anything that has not already occurred to the minds of some of you. I am glad to see there is a movement for the education of our examiners. They are by no means abreast of the day in the kind of questions they often put, and it would be a great stimulus to the teachers of geography if they were to find that examinations turned more frequently upon the intelligence

of the pupil, and upon his mastery of the relations of facts to one another, rather than upon the answering of questions for which he must trust to his memory alone. The best teachers have now realized the importance of endeavouring to familiarize pupils with natural objects, and I hope you will not omit any opportunity of pressing even cycling excursions into your service, and of taking boys, as they do in Germany, upon tours by which they can learn more of the physical aspects of the country than they can learn from books. Perhaps you might do more than is generally done to encourage the reading of books of travel. Noting the absorbing devotion which boys now show to journals which contain reports of cricket and football matches, one is disposed to fear that the private reading of boys, which largely used to consist in reading books of history and books of travel, is perhaps not quite so general as it was some thirty or forty years ago. I am quite sure that nothing helps a boy more to take an interest in geography than if he forms a taste for books of travel, and if his teacher encourages him to do so, and talks to him about what he has read. I am glad to think your Association has begun to receive so much support, and now sees such a useful field opening before it. May I, in conclusion, express to the meeting, and in particular to you, Mr. Freshfield, who have done so much for geographical science as a traveller, and have so frequently and forcibly dwelt upon the value of geography in education, my hearty sympathy with your efforts and my hopes that they may be crowned with success.

INTEROCEANIC COMMUNICATION ON THE WESTERN CONTINENT.*

A Study in Commercial Geography.

By Colonel GEORGE EARL CHURCH, M. Am. Soc. C.E.

During the first half of the sixteenth century, it seemed as if nature herself could not withstand the strenuous efforts of the Spanish conquistadores to find, within the tropics, a strait connecting the Atlantic and Pacific oceans. The quest was fruitless; but it fell to the lot of Magellan to discover, far to the south, the one break in the mountain barrier which stretches from the Arctic ocean to Cape Horn. This rent in the Andes is 310 miles long, measured by its windings. If to the violent currents we add the furious and enduring gales which sweep through its western half from the Pacific ocean, we may understand why the Straits of Magellan have always been a terror to navigators, especially to those going westward. It was not until the famous voyage of Le Maire and Schouten, in 1615–16, that the Cape Horn

* Map, p. 317.

route was discovered; thenceforth sailing vessels found it comparatively easy to round the southern extremity of America.

It does not appear probable that any very useful purpose could be served by interoceanic communication across Patagonia between the Straits of Magellan and 40° S. lat.; not so, however, a little further to the north, where the Neuquen extension of the Southern railway of Buenos Ayres has already nearly reached the eastern foothills of the Andes, and promises, ultimately, to have its terminus on the Pacific coast, probably at the port of Talcahuano. Such an extension would put the best port of the Argentine Republic, Bahia Blanca, within reach of the Pacific ocean by about 900 miles of railway, crossing the Andes by a pass about 7000 feet above sea-level. From 36° S. lat. the passes of the Andes rapidly become lower going southward; but north of this latitude they gradually increase in height, and, between 36° and 27°, the lowest is the Uspallata, 12,654 feet, and the lowest between 27° and 23° is 13,911 feet. In the following 915 geographical miles, as far north as 7° 45′ S. lat., there are twenty-eight transitable passes, very few of which are of practical use, their average height above the sea being 15,350 feet, while the lowest one, about lat. 23°, is 12,983 feet. The carrying of an interoceanic railway across South America through any pass north of 36°, if we except the one under construction over the Uspallata, and a possible one to connect the Argentine railway system with Copiapó, in Chile, would not be within the limits of reasonable engineering and finance; and not until South America is densely populated would there be any *raison d'être* for such a line north of the latitude of Copiapó. It may, however, be that some of the Argentine railways in the province of Buenos Ayres may find their way to the Pacific coast. The "Trans-Andine" now lacks but 43 miles to form a connection with the Chilian lines, and thus complete a through route between Buenos Ayres and the port of Valparaiso, a total distance of 881 miles, of which 760 are in the Argentine Republic, and 121 in Chile. The summit tunnel at the Uspallata pass is 10,460 feet above sea-level. When opened to traffic, this railway must have a marked and beneficial effect upon the friendly, political, and commercial relations of the two countries. Its value for passenger traffic and local trade must be great, but we may be allowed to doubt if European merchandise, other than goods of great value, and requiring rapid transit, irrespective of cost, can afford to take this route to Chile in preference to that by the Straits of Magellan, although some European and Asiatic goods may find their way from Valparaiso across the Andes to Mendoza and the western Argentine territory.

The railways which have scaled the Cordillera from the Pacific coast into Bolivia and Perú may be regarded as local lines, which never will become transcontinental, except perhaps in connection with affluents of the river Amazon. The Antofagasta railway might be extended

from Oruro to Cochabamba, and thence to the Chaparé, Chimoré, or Securé branch of the Mamoré affluent of the river Madeira. By some 600 miles of fluvial navigation, the falls of the Madeira would then be reached, where a further length of railway would be required to make the portage of the 263 miles of river barred by nineteen formidable rapids and cataracts. From the lower fall, San Antonio, to the sea, 1533 miles, there is no obstacle to safe and easy navigation for large river-steamers; while in the rainy months this fall may be reached by ocean craft drawing 20 feet of water.

In Perú the difficulties encountered in descending the Atlantic slope of the Andes are enormous. Vast capital would be required to overcome them, and he must be a bold engineer, careless of the relations of engineering to productive expenditure, who can recommend the carrying of any of the existing Peruvian railways down the Andes into the Amazon valley. The lowest pass of the Peruvian Cordillera is in 7° 45′ S. lat., and, according to Raimondi, is but 7170 feet above sea-level. It cannot serve for interoceanic communication; for could a railway be carried across the interminable tangle of profound gorges into which the whole mass of the Andes is broken on this parallel of latitude, it would have to be extended past the *pongos* of the river Marañon to Achual point, east of the Pongo of Manseriche, where the Marañon breaks free from the mountains. Achual point, 2786 miles from the sea, can be reached by vessels drawing 14 feet of water at all seasons, but large ocean steamers can ascend the Amazon to Iquitos within 486 miles of Achual point.

Ecuador offers fewer obstacles than Perú to interoceanic communication. Many travellers who have crossed the continent have taken the route from Guayaquil to Quito, and thence down the Napo river, which drains the slopes of the gigantic volcanoes Antisana, Sincholagua, Cotopaxi, and Cayambé, the last almost cut by the equatorial line; but this route is not the best for a railway, and, if ever connection be established with Amazon navigation, it will probably be across southern Ecuador, and down either the Pastaza or Morona river. These have been the field of numerous explorations with the vain hope of finding one of them sufficiently navigable for purposes of trade between Ecuador and Brazil.

A railway is now under construction from the Gulf of Guayaquil across the Chimbo and Palmira passes of the Andes, probably the most difficult piece of engineering ever attempted in South America. The summit height of the railway, at a tunnel half a mile long, is 10,600 feet above sea-level, the Palmira pass being 12,200. From Guayaquil to Quito, the distance by rail will be 286 miles. The tableland has been reached, and 115 miles are nearly ready for traffic. It is anticipated that the entire railway will be opened to Quito by July, 1902. Some 40 miles of the part already built has gradients of 4 per cent., and over 5

miles are $5\frac{1}{2}$ per cent. The sharpest curves are 191 feet radius. Through the towns of Rio Bamba and Ambato, which are stations on this line, run branches of the Pastaza affluent of the Amazon. It would be of much commercial interest were the railway company to carry a rough preliminary survey down the Pastaza or Morona, to see if they can, by the construction of a branch line, reach a point accessible to Amazon river-steamers; otherwise their railway will serve entirely for the local development of the productive inter-Andean valleys and arid plateaux of Ecuador.

The easiest and shortest transcontinental route which could be opened between Patagonia and Colombia would be from a port in north-west Ecuador, from which the Andean tableland could be reached by rising to 7300 feet above sea-level, and thence, through the eastern chain of mountains, descend to the head of navigation on the Içа branch of the Amazon. Crevaux ascended the Içа, day and night, in a steamer drawing 6 feet of water to Cuemby, and did not find a single rapid. Cuemby is 800 miles above the mouth of the river, and only 200 miles distant in a straight line from the Pacific ocean. It is difficult, however, to understand what important advantages would be gained by the opening of such an interoceanic highway. It seems to be too far north to be of any great value to the commercial development of South America.

The idea of a transcontinental avenue, crossing from the Pacific ocean to any of the navigable branches of the river Orinoco, may be dismissed as impracticable: the Occidental, Central, and Oriental mountain chains of Colombia, with their deep intervening gorges, would always have to be crossed at a right angle, and the descent of the storm-worried slope of the Andes to a point on some affluent of the Orinoco, within reach of the Atlantic by craft of reasonable size, would be an engineering and financial operation as gigantic as it would be unproductive.

We now come to the most interesting region of the Western continent, so far as geography is concerned—Panamá, Costa Rica, and Nicaragua, which once formed part of a vast archipelago, where, winding among its islands, the Caribbean sea connected with the Pacific ocean. This region is now scored by numberless torrential rivers, and is everywhere covered by thick tropical forests, fallen trees, thorny vines, and dense, tangled jungle hiding vast and pestiferous swamps among the mountain ridges and chaos of highlands and hills. From the Andes, north-west, as far as Puertobelo, low sierras, from 500 to 2700 feet high, border the Atlantic coast, but break down a little later at the Chagres river along the line of the projected Panamá canal. Here the summit between the two oceans is only about 300 feet elevation above sea-level; but thence towards, and pushing into, Costa Rica the country gradually rises again, filling the isthmus with complex mountain masses having a maximum height of 7000 feet. West of

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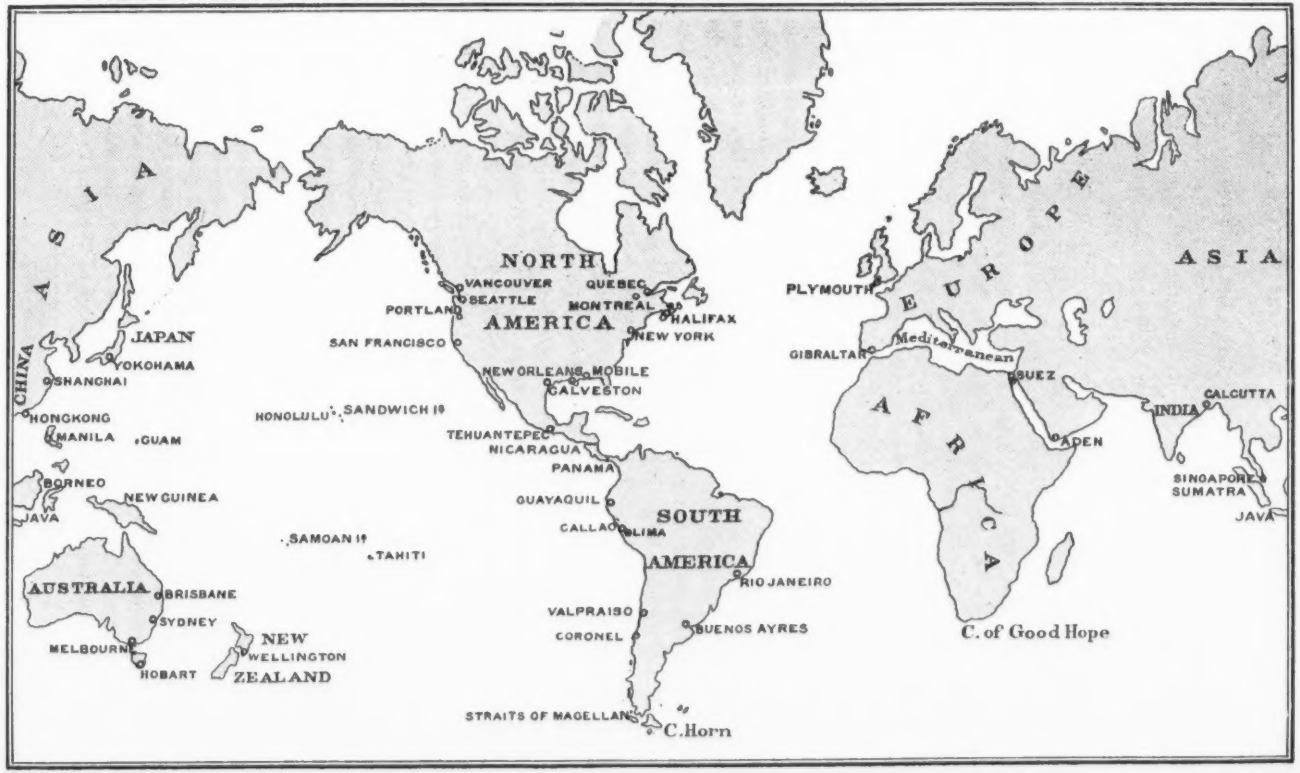

Montijo bay, a massive counterfort forms the peninsula of Azuero, with headlands rising to 3000 feet. From the northern slope of the state of Panamá, 149 short rivers empty into the Atlantic, and, from the southern one, 326 flow to the Pacific ocean.

Across Costa Rica, between its northern volcanic section of mountains and the more regular Talamanca range, which extends to the isthmus of Panamá, is a depression (about 20 miles broad from 9° 40′ to 10° N. lat.) a little less than 5000 feet altitude at the water-parting. Eastward from this, the tumultuous river Reventazon flows to the Atlantic through a deeply eroded valley, up which the Costa Rica railway climbs; and westward to the Pacific, flows the little river Pirris. Bounding the depression on the south, the Chirripo Grande mountains send off two immense flanking counterforts, one to the Atlantic, one to the Pacific coast. This transverse, lofty, precipitous barrier almost forbids communication between the northern and southern halves of Costa Rica, both of which present lines of mountain masses instead of serrated crests, which rise at times to above 11,000 feet altitude. In the northern section are the twin volcanoes of Turialba, 11,017 feet, and Irazú 11,200; then come the volcanic masses of Barba, 9335, and Poas, 8675 feet, and thence the irregular, broad, and volcano-dotted chain, about 60 geographical miles long, extending north-west and gradually breaking down until lost at the river Sapoa, one of the boundaries between Costa Rica and Nicaragua. This chain is of eruptive origin, basalts and trachites predominating; but extensive sedimentary rocks are found on its slopes, as well as vast loose deposits of boulders, clay, earth, and volcanic material, the whole generally saturated with water, and sometimes sliding millions of cubic yards of *débris* into the valleys. In fact, I have seen cases where a whole mountain seemed to be moving, and as uncertain in its stability as a sponge. Against the north-eastern slopes of Turialba, Irazú, Barba, and Poas, the north-east rain-laden trade winds beat with relentless force. To quote from my "Costa Rica,"* "I rode from San José across the pass, between Irazú and Barba, nearly to Carillo. The ride to the summit was easy, but rarely in the Andes have I seen such perpendicular, dark, and profound gorges as I found carved out by the storms on the northern slope of Irazú. Although the mountain range behind me had evidently been uplifted, and numerous volcanoes had piled their *débris* high above the general level, to these were due in part the vast inclined plain before me, which, with a very low ridge between the rivers Frio and San Carlos, pushes northward to form the dam which holds Lake Nicaragua in its present place, at a mean elevation of 105 feet above the sea." Among the Nicaragua foothills, at the northern edge of the plain, runs the San

* *Journal R.G.S.*, July, 1897.

Juan river, which is the drainage outlet of the lake; and among the streams which contribute to the volume of the San Juan are the Sarapiqui and San Carlos, fed from the slopes of Irazú, Barba, and Poas. I have seen the Chagres in flood, but doubt if it can match the Sarapiqui, which, from a gentle river, becomes a deep and mighty torrent, in a few hours, when swollen from the storm waters of the mountains. Then it seems irresistible; it picks up boulders of a quarter of a ton weight and whirls them along in its current as if they were little pebbles, at times tossing them over its banks to the right and left.

"One of the affluents of the Sarapiqui, the Amarillo branch of the Sucio (not to be confounded with the Toro Amarillo), which I forded between Guapiles and Carillo, has made wild work over a breadth of from 5 to 6 miles of country, leaving a black, boulder-covered track to mark every change of its erratic moods. Where I crossed it, the boulders were strewed, for half a mile in width, by hundreds of thousands of tons. No wonder, when the river brings its artillery into action, the cannonade may be heard for miles." The plain crossed by the Sarapiqui has taken the place of part of the great strait which once connected the Atlantic and Pacific waters, probably joining the latter near Brito as well as through the depression occupied by Lakes Nicaragua and Managua. Here we have the lowest break in the Andean Rocky mountain chain between the Straits of Magellan and the Arctic sea. It is 153 feet above sea-level, and here is one of the routes available for the remarriage of the oceans.

The isthmus of Panamá, together with the coast to the east as far as the Cabo de Vela, was originally called Castilla del Oro. Oviedo y Valdez estimated its Indian population at 2,000,000, when Pedrarias Dávila was named Captain-General and Governor of the province, in 1513, and commenced his career of human slaughter. The first town there was founded by the famous pilot Juan de la Cosa, after the loss of his two ships. Between the gulf of Uraba (or Darien) and the isthmus of Tehuantepec, we have the region of the New World which, during the first third of the sixteenth century, was the field of search for the strait which was supposed to exist between the Atlantic and Pacific oceans, and which, could it be found, promised to make the monarchs of Spain masters of the commerce of the Orient. Hence the crown constantly urged its adventurers to discover it, and these, regardless of life and treasure, and despite hardships which tested even the courage and fibre of such men as the Spanish conquistadores, persistently pushed their explorations into every inlet, estuary, and river, and through every gap in the forest-covered hills and mountains of the stubborn barrier of land which stood athwart the ambition of their sovereign. The first thirty years of the sixteenth century, so far as the region in question is concerned, may be called the Period of Exploration, dedicated principally to the discovery of the "secret of

the strait." One of the first expeditions was sent, in 1516, from the Pacific side of the isthmus. It found a large gulf to the north-west of Panamá, and gave it the name of San Lucar. The Chinchires indians there gave the explorers to understand that further north there was a communication between the two oceans through a great interior lake. This information was allowed to sleep until after the conquest of Mexico by Cortes, who, in common with Pedrarias Dávila, received urgent orders from the Spanish government, in 1521, "to discover the secret of the strait." At this time, Gil Gonçález de Avila, by virtue of a "capitulacion" made with Charles V., arrived at Panamá with authority to discover a certain extent of country to the north-west of that isthmus. He sailed with an expedition, in January, 1521, for that purpose. In his memorial to his Catholic Majesty,* de Avila says he "has discovered so great a thing as the *Mar dulce*, and from it, and the neighbouring lands, he trusts in God our Lord, and the good fortune of your Majesty, to send to your Majesty an amount of gold sufficiently great to bring to the service of God our Lord all the infidels of Asia and Africa."

The Indian name of the great *Mar dulce* was Cocibolca; but the Spaniards called it Nicaraoagua in honour of the chief Nicarao, who ruled the district. De Avila learned that the lake had a communication with the north sea, but that it was cut off from the south sea by the coast belt of land. He was told that there was another lake north-west of Lake Nicaragua, called Xolotlan (now Managua), which connected with it, and when afterwards he entered the beautiful bay of Chorotega, which he named Fonseca, in honour of the President of the Council of the Indies, the information given him by the Indians led him to believe that Lake Managua had an outlet into that bay. For more than a century, the Spanish maps and descriptions made the great lake of Nicaragua empty into the comparatively insignificant Managua. Certain that he had discovered the "secret of the strait," De Avila hurried back to Panamá. The account of his explorations awoke all the ambition and worst passions of the astute and cruel octogenarian Captain-General Pedrarias Dávila, resulting in the turning of Nicaragua and Honduras into a shambles for several years, with plenty of bloodshed among the followers of rival conquistadores who held conflicting powers from the Spanish crown, each determined to control the region which might become the transit route between Europe and the Indies. In 1527, Diego Lopez Salcedo, a vain, arrogant man, was in command of Nicaragua, with royal instructions to found a city near the outlet of the lake, "because his Majesty desires that the river be explored, and that it be ascertained if it be navigable to the sea, and if it will give

* See 'Coleccion de Documentos para la Historia de Costa Rica,' por Hernandez, vol. iv. Doc. 1, from Archivo General de Indias.

passage between the two oceans." According to the royal will, thus expressed, Salcedo, in 1527, instructed Gabriel de Rojas to discover the drainage canal (the desaguadero) of Lake Nicaragua. It is curious to note that the service of God was secondary to the acquisition of treasure in the mind of the avaricious governor. He says in his instructions,* "At present I am informed, and it is held to be true, that towards the north sea, by the way of the *desaguadero* of the *laguna* of the city of Granada, there are large towns, riches in gold, silver, pearls, and other things; and as it is well for the service of God and of his Majesty, and good for said inhabitants and people of those parts and natives of the land that an end be put to those secrets," etc. Rojas organized his expedition when, in 1528, Pedrarias Dávila superseded Salcedo, and soon after named Martin Estete to carry out the desired exploration. The latter, according to Herrera, took his expedition overland to Nombre de Dios; but Levy, in his work on Nicaragua, says, without stating his authority, that Estete partially descended the *desaguadero*, and named it the San Juan river. It was so dry that he could not pass the rapids. At the death of Pedrarias Dávila, in 1531, Rodrigo de Contreras was Governor of Nicaragua. He gave to Captains Diego Machuca de Çuaço and Alonzo Calero the command of an expedition, about 1534, to explore the river San Juan. According to documents in the Archivo General de Indias, these captains made several voyages to examine the San Juan, in large craft built for the purpose on Lake Nicaragua, and up to 1539 they had made several voyages to Nombre de Dios by the way of the San Juan river.†

In 1540, Comayagua, in Honduras, was founded halfway between the two oceans, with a view to facilitate communication between Puerto Caballos, now Puerto Cortes (founded by Cortes), and the great bay of Fonseca. It was believed that this route for Spanish trade with South America would prove healthier and better than that of Panamá, which was declared by many conquistadores to be the "sepulchre of the living." In 1556, Juan Garcia de Hermosilla pressed this route upon the king as the result of his examination of it, under royal instructions, in 1554. His recommendations were supported by several eminent Spaniards, including the cosmographer Gutierrez. But it was all without result, and the effort of Felipe de Aniñon to revive the idea in a memorial to the king, in 1565, was equally futile, as was also that of Garcia de Palacios in 1578. In 1586, a celebrated Italian engineer, Antonelli, was sent to survey the route, and, with his companion Tejada, made a favourable report upon it in 1591. The opposition, however, from various sources, became too great, and the road was never opened,

* 'Coleccion de Documentos Ineditos,' vol. xiv. Archivo de Indias.

† See Archivo de Indias, Simancas, quoted by Peralta in his 'Costa Rica Nicaragua y Panamá.'

although there is little doubt that in many respects it offered advantages superior to those of Panamá. The distance between Puerto Cortes and the bay of Fonseca, on the line of the surveyed road, is about 200 miles, and the summit elevation 400 feet above sea-level.*

The great Cortes, *facile princeps* among the conquistadores, sent several expeditions in quest of the "strait," the "secret" of which the Crown so persistently urged its captains-general to discover. Scarcely had he obtained control of Central Mexico, than, with methodical and comprehensive genius, he first verified the existence of the South sea, and in his third letter to the Emperor, dated Cuyoacan, May 15, 1522,† he gave an account of his success in this regard. In his fourth letter, October 15, 1524, he says that he has sent Cristóbal Dolid "to colonize the point or cape of Hibueras" (Honduras) "sixty leagues east of the bay of Ascencion to the windward of Yucatan, the coast above Tierra Firme towards Darien, from the fact I have much information that the land is very rich, as well as, in the opinion of many pilots, by that bay a strait leads to the other sea, which is the thing which I, in this world, desire most to hit upon." The activity of Cortes as a geographical explorer was remarkable; with tireless efforts, he at this time fitted out no less than three expeditions, and all from his own private resources—one in Honduras, one "to examine the whole coast of the bay of Asuncion in search of the strait believed to exist there," and the third for Guatemala. It is evident that his masterful mind never rested in the search for geographical knowledge regarding every part of the New World, and that even the Atlantic coast-line of North America was probably known to him before its outline became known in Europe in July, 1524, as the result of Verrazano's voyage; for he searched for the coveted "strait" "from the coast of Florida to the *bacallaos*"—the cod-fisheries. In 1524 he says, "Thus I think of sending the vessels which I have had built in the South sea, which, if it please God, will sail at the end of the month of July of this year, by the same coast southward in search of said strait; for if it exist it cannot escape the notice of either those going south or of the others by the North sea; because those of the South will follow the coast until they find said strait, or until the land reaches that discovered by Magellan; and the others of the North, as I have said, until it joins the *bacallaos*. Thus, on one side or the other, the secret cannot fail to be known."

"A knowledge of the Atlantic coast-line of North America must have closely followed on the discovery of Florida. There can be no

* 'Honduras, Descriptive, Historical, and Statistical.' By E. G. Squier.

† 'Cartas del famoso Conquistador Hernan Cortes, al Emperador, Carlos Quinto.' Mexico, 1870.

doubt that in these early years many voyages were made to the shores of the New World of which no record remains, . . . these were undertaken in search of the strait leading, by a western passage, to the Indian ocean, which had been sought ever since Columbus reached the great barrier of the American shore." *

In practice it has been found that Panamá offers a better crossing between the Atlantic and Pacific oceans than any other point. It was the route used by Spain, up to 1726, for her *flota* and *galeon* trade with the west coast of South America. Her fleets, after leaving Cartagena, proceeded to Puertobelo, near the present port of Colon, and their cargoes were then carried across the isthmus. The road was a rude one, but by dint of slave labour and much sacrifice of life, it was made serviceable to the extent demanded by the limited commerce of the times.

When swarms of buccaneers had made the voyages of Spanish ships to and from Cartagena extremely dangerous, and an English fleet, under Admiral Vernon, had, in 1740, pounded Cartagena and Puertobelo to pieces, Spain almost entirely abandoned this highway to Peru in favour of the one by Cape Horn, which Le Maire and Schouten had demonstrated to be practicable. The treasure-hunter changed his route, and Panamá was left in comparative rest, until about a century later it found itself on the line of quickest transit between the Atlantic coast of the United States and the territory of California, acquired by the United States from Mexico, under the Treaty of Guadalupe Hidalgo. Again the thirst for gold drove humanity and merchandise in an almost ceaseless stream over the old Spanish road across the isthmus of Panamá; but this time the current was Anglo-Saxon—the Spanish one had been completely diverted, and confined, in the New World, to Cuba and Puerto Rico. Meanwhile, the long period of exploration had demonstrated that the only way to correct the blunder of nature was to unite the oceans by a ship-canal, and from that day to this the problem has been where to cut it. Almost numberless expeditions have been despatched to study it, and, from the Atrato river to Tehúantepec, many routes have been surveyed by able engineers. Whoever casts his eyes upon a map of the narrow barrier joining North and South America, instinctively projects a canal across it. Thus it is Vasco Nuñez de Balboa, the discoverer of the Pacific ocean, and no one else, to whom the honour should be given of being the original projector of a Panamá maritime canal. It was Cortes who first called attention to the geographical advantages possessed by the isthmus of Tehúantepec, and, after abandoning all hope of discovering the "secret of the strait," he wrote, in his fifth letter to Charles V., 1526, "as no strait can be

* E. J. Payne, in his 'History of the New World called America.'

discovered, I think of making a road by this way for the Spice islands." Here the Emperor conceded to him the vast estates, of about 300 square miles, still known as the Marquesanas, while another part of his Marquisate comprised the town of Tehúantepec and the harbours of Zacatula and Acapulco. He thus controlled the best points on the Pacific coast of New Spain for communication with the Indies. Acapulco, during the colonial period, became the galeon port for the Spanish trade with the Philippines.

Since the days of Cortes, the isthmus of Tehúantepec has been considered a probable interoceanic route, and in 1814, according to José de Garay, the Spanish government, in view of the various reports, authorized the cutting of a canal there in preference to Nicaragua or Panamá. After the independence of Mexico, the government of Mexico gave de Garay a privilege to open communications "by canal or railway" across Tehúantepec, but it lapsed. Since then, nearly a dozen fruitless concessions have been granted with the same object in view, until, tired of giving them, Mexico unwisely built the existing railway for government account. The line is 192 miles long from port to port, and its summit height 886 feet above sea-level. The enterprise was of great commercial importance until the restless wave of humanity commenced to chase railways across the continent further to the north; but once these reached the Pacific coast, the geographical advantages of Central America were flanked, and Tehúantepec, like Panamá, became of little consequence in the world's trade.

Railway communication across Costa Rica will ultimately be opened. The English company's line extends from Port Limon, on the Caribbean sea, to Alajuela *viâ* the capital San José, which is on the Pacific slope. From Limon to the latter city it is 103 miles, and the summit height, at the ninety-second mile, is 5102 feet above sea-level. The government is now building a line from San José to the Pacific coast; when completed, it will form part of an interoceanic route, of but little value for through trade.

It is a remarkable coincidence that on the same day that the Treaty of Guadalupe Hidalgo was signed, February 2, 1848, ceding California to the United States, gold was discovered at Sutter's mill, 40 miles from Sacramento. The news crossed the continent, and reached New York in November of the same year. Then commenced the rush for the west coast of North America. The story of the birth of empire in California I heard from the lips of the grand old pioneer, Captain Sutter himself, who died a penniless wanderer. Thousands of fortune-hunters embarked from the Atlantic ports of America in rapid succession; some of them crossed the isthmus of Panamá, others Nicaragua, and many found their way to the goldfields by rounding Cape Horn. It was a recrudescence of the old Spanish gold-fever, during the delirium of which, in the sixteenth century, crowds of

adventurers traversed the same interoceanic barrier in quest of the precious metals. The direct journey across the continent, in 1848, could only be made along trails constantly threatened by indians. Hence fever-stricken Panamá became the great highway, although for a time partly rivalled by the route of the San Juan river and Nicaragua, until the demands of travel and commerce called the Panamá railway into existence. This was the first interoceanic railway ever built. It is $47\frac{1}{2}$ miles long, was commenced in 1850, and the first locomotive passed over it from ocean to ocean January 28, 1855. Its construction accentuated the importance of an interoceanic canal, and the right to cut this was included in the railway concession from Colombia.

The original Spanish road from Nombre de Dios to the south side of the isthmus, 18 leagues of misery and curses, was much improved by a change which, by the way of the river Chagres, brought the journey more within the limits of human endurance and Christian fortitude. How painful it was to man and beast in Spanish times is shown by the cost of transportation of goods, which, according to the memorial of Diego de Mercado to Philip III. (1620),* was, "from Puertobelo to Panamá, for ordinary merchandise, $25 to $30 of assayed silver for every 200 lbs.," say from £55 to £65 per ton. It is evident that, under such conditions, trade could not be carried on except to an extremely limited extent; hence, in the middle of the last century, the Panamá railway came to the relief of man and brute as they struggled to the death in the floods, swamps, mud, tropical rains, and scorching sunshine, across the pestilential isthmus to meet the heartless requirements of trade. An iron track and the modern locomotive solved the transit problem for a time; but no one then realized that, further to the north, the locomotive was destined to outflank a merely geographical position, and largely destroy the value which nature had apparently given to it. So far as trade routes were then concerned, Panamá was strategic to the highest degree, and why should it not remain so? Nations, since the days when the merchants of the Euphrates wrote their bills on terra-cotta plaques, had seized on the most commanding geographical points for political and commercial control, but these could alone be made valuable in connection with means of transportation, which were the sailing ship, horse, ass, camel, ox, elephant, and llama. Six thousand years of experience with them cause us, with a species of atavism, to cling to them at times, and to overlook the fact that the locomotive and steamship make geographical advantages of secondary consideration in the selection of trade routes. Were overland transportation still carried on by ancient methods, an interoceanic canal

* 'El Canal Interoceanico de Nicaragua y Costa Rica en 1620 y en 1887.' By Manuel M. de Peralta.

across Panamá or Nicaragua would be an inestimable boon to the commerce of the world, and we might safely follow the lead of Charles V., and the kings who succeeded him, in the effort to break through the barrier which divides the oceans.

It is a common opinion that the success of the Suez canal is a proof that one at Panamá will be equally successful. A canal, to unite the Mediterranean and Red seas, is first cut by the engineers of Rameses II.; afterwards, choked with sands, it is reopened by Pharaoh Necho, and utilized by his great fleets; again it is buried by the desert, and, after a lapse of centuries, the Persians, under Darius Hystaspes, make a fruitless effort to restore the waterway. The desert remains the master, until the great Frenchman, Lesseps, appears, and, delving beneath the forgetfulness of nearly twenty-five centuries, with the aid of French capital and Egyptian forced labour, restores the connection between the two seas, and gives us the modern Suez canal, now active with the commerce of the world; not carried in the little craft of the Pharaohs, but in that gigantic compendium of all civilization, the modern steamship.

If Lesseps could accomplish such marvellous results in the East, why not in the West, influenced and urged on by the financial enthusiasm created by the success of Suez? If Suez gave such excellent returns upon its capitalization, why should not Panamá, "similarly situated," do the same? What mattered if the new project involved, not the cutting of a canal through a level desert in the temperate zone, but through a tropical, inhospitable mountainous region, saturated by a yearly rainfall of 10 feet?

And thus the work was undertaken, and the engineers of England and the United States, if not of other countries, looked on astounded at the *gaieté de cœur* with which the assault was delivered. From the ruins of the undertaking "The New Panamá Canal Company" emerged, October 20, 1894, to spend such moneys as could be saved out of the wreck of the old one,* and to demonstrate, by thorough engineering studies and continuation of the work, that the enterprise is feasible, but on the basis of a canal with locks, in substitution of the original project of a canal at sea-level throughout.

In a publication of the new Panamá Canal Company of 1899, they say, "The work was commenced in 1881. After employing two or three years in making more careful and thorough surveys, and in preparatory work, the real difficulties of the undertaking began to be understood. . . . It must be recalled that there had been great want of

* "The old Panamá Canal Company and the Liquidator raised by the sale of stock and bonds the sum of $246,706,432. The securities issued to raise this money had a par value of $435,559,333. There had been excavated about 72,000,000 cubic yards prior to the organization of the new company" (*vide* 'Preliminary Report of the Isthmian Canal Commission,' November 30, 1900).

foresight in proportion to the importance of the work, and this explains the grave consequences which ensued. . . . The expenditure actually made upon the isthmus amounted to £31,300,000."

In June, 1899, the United States Government appointed a commission of eight eminent engineers, under the presidency of Admiral Walker, "to determine the most feasible and practical route across the American isthmus for a maritime canal between the Atlantic and Pacific oceans." Thirty-one working parties were organized and sent into the field, of which twenty for Nicaragua, five for Panamá, and six for the Darien country.

According to the report of the commission, the surveys show that the Nicaragua and Panamá routes are the only feasible ones; but it appears that the concession of the Panamá Railway Company, controlled by the New Panamá Canal Company, will expire August 16, 1966, and should the latter fail to comply with its own concession, which entitles it to the usufruct of the canal until October 31, 2009 (always providing it be opened to traffic by October 31, 1910, now an impossibility), it will have to fall back on the railroad concession, the canal, at the termination of the time period, becoming the property of the Colombian Government, without compensation. Other vexatious conditions environ both concessions. To add to the complications, the old Panamá Canal Company is entitled to 60 per cent. of the net earnings of the new company. Laying aside the questions of engineering, cost of works, value of geographical position, and the difficulties incident to negotiating with the old and new canal companies, the United States would hardly be justified in committing itself to the Panamá route without first concluding a treaty with Colombia, making the canal concession perpetual, especially as such a treaty might be negotiated with the two governments controlling the proposed Nicaragua route.

The technical features of the rival canal routes are substantially as follows:— *

Nicaragua.—The lake has an area of about 3000 square miles. There are reasons to believe that its surface is sometimes as high as 110 feet above sea-level, and then again as low as 97. It is separated from the Pacific ocean by the continental divide, from 12 to 30 miles wide, with a summit height of 153 feet above sea-level. It discharges into the Caribbean sea through the San Juan river, which is tortuous and flows through a hilly country in its upper part. The distance from the lake outlet to the mouth of the river is about 80 miles in an air line, but about 120 by the windings of the river. The annual rainfall near Greytown sometimes amounts to 300 inches. The average

* 'Report of the Isthmian Canal Commission, 1899–1901.' 55th Congress, Senate Document 54. Washington, 1901. Also Preliminary Report, November 30, 1900

is probably 260 to 270. In the drainage of Lake Nicaragua, the yearly fall is about 65 inches.*

The total length of the canal is—

	Miles.
From the Caribbean sea to the lake, including about 28 miles of river improvement and about 17 not requiring improvement	95·81
Lake crossing, including the excavation of 28·73 miles of channel	70·51
Crossing of continental divide to Brito on the Pacific	17·34
Total from ocean to ocean	183·66

Estimated cost, $189,864,062.

A ship drawing 32½ feet of salt water will draw nearly one foot more in fresh water, and require for safe navigation not less than 35 feet of water in the canal. This depth is therefore fixed as the minimum in all the channels. "The broadest battleship afloat is the *Regina Margherita*, recently launched. . . . The increase in the beam of warships is unmistakable; . . . the width of locks is therefore fixed at 80 feet, with a view to provide for some further increase." The largest commercial ships are longer than the largest warships; therefore the length of locks is fixed at 740 feet. The bottom width of the canal is to be 150 feet. That of Suez is now 115, and its depth 27 feet 10 inches. Twin locks are to be provided in every case. Lake Nicaragua will be reached from the Atlantic side with one lock of 36·5 feet lift, two of 18·5 feet, and one of from 31 to 37 feet lift. The descent to the Pacific from the lake will be by one lock of 22·5 to 28·5, two of 28·5, and one of 20·5 feet lift at mean high water, or 28·5 feet at mean low water. By means of dams and regulating works, the lake-level is to be held within a limit of 6 feet fluctuating elevation, or from 104 to 110 feet above mean sea-level. The most difficult engineering work will be the Conchuda dam, estimated to require four years to build. The greatest depth to hard rock will be 82 feet, the crest of the dam above its foundation 135 feet, and its total length 1271 feet, with foundations on hard rock the entire distance. There are heavy cuttings near San Carlos and Tamborcito, the maximum near the former place having a depth of 218 and 170 feet "for short distances, while at Tamborcito, 26 miles from Greytown, there is a cut 297 feet deep for a distance, at the base, of 3000 feet, nearly all hard rock." Greytown harbour, once excellent, is now silted up and almost obliterated. It is proposed to excavate it to a depth of at least 35 feet, the area to be protected by jetties, "and its maintenance will require an extension of the jetties or dredging, or both." An artificial harbour has also to be constructed at Brito, but the maintenance will be less costly than the one at the Atlantic entrance to the canal.

* The alignment is inferior to that of the Panamá canal. The sharpest curve is 4045 feet, and the total curvature 2340 degrees.

PANAMÁ.—The location selected by the commission is, in general, the same as that proposed by the French company. The total length, from 36 feet deep in the Atlantic to the same depth in the Pacific, is 49·09 miles; but from the inner end of the harbour of Colon to the shore end of the Boca channel on the Pacific side it is 42·3 miles, of which 11 miles will be in the broad channel of the artificial lake Bohio. The alignment is exceptionally good, the sharpest curve having a radius of 6232 feet, except one of 3280 at the entrance to Colon harbour. The total curvature of the canal is 771°. From the inner end of the harbour at Colon, a level length of 14·42 miles will reach the Bohio double flight of locks, which will have a total lift of 82 feet at the minimum level of the proposed Bohio lake, to 90 feet at its maximum, or 41 to 45 feet lift at each lock. There are to be four lock-chambers in all, of the same type as those designed for Nicaragua. Their estimated cost, including excavation, is $11,567,275.

In the construction of a ship-canal at Panamá, a problem of the first magnitude is the control of the Chagres river. It is about 145 miles long, with a drainage area of 875 square miles. It flows through a mountainous district which has an average yearly rainfall of about 130 inches. A maximum fall of 6 inches in twelve hours has been observed. The precipitous slopes of the valley give the stream a torrential character. It rose at Gamboa, in December, 1891, 23 feet in sixteen hours. It is the formidable obstacle to the cutting of a sea-level canal as originally projected by Lesseps. The quantity of excavation required for such a canal has been roughly computed at 266,228,000 cubic yards, and twenty years as the time required to complete it. Therefore, although physically practicable, it has been rejected in favour of a canal with locks. In consequence, the Chagres river must be impounded, and it is proposed to build a dam at Bohio for this purpose, and form a great reservoir, to be called Lake Bohio. This will have a normal water surface of 38·5 square miles, increasing to 43 when the lake reaches its maximum level, when it will contain over 210,000,000 cubic yards of water.

The Bohio dam will be the most important work of art on the line, and its foundations, which will be on rock, are to be 128 feet below sea-level. Its length will be 2546 feet, and its top 100 feet above sea-level. Therefore the total height of the dam, from foundation to crest, will be 228 feet. It will have a masonry core 30 feet thick at and below −30, with earth faces designed to have mean slopes of one vertical to three horizontal, broken by three terraces, each 6 feet wide. It is probable that both faces will be heavily riprapped with the rock spoil from the lock excavation. The cost of the dam is estimated at $6,369,640, a higher estimate than any heretofore made. Lake Bohio will form part of the canal itself for a distance of 12·68 miles. Ships will reach it by the flight of Bohio locks above mentioned.

Leaving the lake, the celebrated Culebra cutting is entered; this is 7·91 miles long, from the Obispo guard-gates, near the lake, to the Pedro Miguel locks, by which the descent to the Pacific ocean will be in great part effected. The summit of the cutting is about 5 miles distant from the Obispo gates, where the bottom of the canal at the axis will be 286 feet below the natural surface of the ground. Soft materials on top, some hard rock at the east end, 2 miles of ordinary materials at the western end, and the remainder of indurated clay and some strata and dikes of hard rock, are the characteristics of this gigantic excavation of 43,237,200 cubic yards, which, it is thought, will require eight years to complete. The entire cut will be lined with masonry walls to 2 feet above high water. There will be a bench 38 feet wide on either side, on one of which the Panamá railway will be laid, while it is probable that a service track will occupy the other. The estimated cost of the 6·02 miles of heavy work is $41,940,480, and of the 7·91 miles, $44,414,000, including the upper approach to the Pedro Miguel locks. These will be similar to the Bohio ones, and will have an aggregate lift of from 54 to 62 feet. A level of 1·33 miles will extend from them to the Miraflores lock, the last required to reach the ocean, and which will have a lift varying from 18 feet at high tide and 38 feet of mean low tide. For 4·12 miles beyond the Miraflores lock, the canal goes through a low swampy country to a point called La Boca, where there is a substantial wharf, and from here a 4·41-mile channel will be excavated to the 6-fathom line in Panamá bay.

The total estimated expenditure required to complete the canal is, including 20 per cent. contingencies, $144,233,358. The value of the work already done is computed at $36,324,033, which includes $2,000,000 for maps, drawings, and records; but the Isthmian Canal Commission adds for contingencies "to cover omissions" sufficient to make the total $40,000,000.

There is a third route which seems to again be seeking favour, and that is the old Darien one, known as the San Blas, from the great gulf of that name on the Atlantic side of the isthmus. It is supported by a strong group of capitalists, headed by Senator Hanna, whose political power is well known. Under the able scientific guidance of General Edward W. Serrell, one of the most eminent engineers in the United States, they seem to be gaining ground at Washington, and, possibly, may yet induce Congress to seriously consider the advantages which they claim for their project. "The length of canal would be 27 miles only, in a straight line, and cut at sea-level, without locks, at an estimated cost of £22,000,000. Twenty-three miles will be through a low flat country, and the other four a gigantic tunnel through the solid rock of a mountain ridge, about 1200 feet high at its summit," the tunnel to admit the passage of the largest ships.

Some rough examinations were made of this route, in 1870, by a United States expedition under Commander Selfridge. He estimated the length of the required tunnel at 10 miles, and pronounced it impracticable. The length of the canal would be 27 miles from ship navigation on the Mandinga river, flowing to the Atlantic, to ship navigation on the Bayamo river, emptying into the Pacific; but the width of the isthmus from ocean to ocean is 37 miles. "In the north-west corner of the great gulf of San Blas is an inner harbour formed by a circle of islands, with a passage a mile wide leading into it, capable of holding easily all the shipping that an immense traffic might demand of it. This harbour, magnificent for all purposes required as the great terminus of an interoceanic canal, was sufficient in itself to attract attention to this portion of the isthmus." The 'Preliminary Report of the Isthmian Canal Commission' (1900) says, "The San Blas route extends from the bay of that name to the mouth of the Bayamo, on the Pacific; it has been advocated as the shortest line between the two oceans, which is true. The most complete plan developed involves a tunnel at least 7 miles long. While not necessarily impracticable, such a tunnel would be very objectionable, and would render the line inferior to the Panamá or the Nicaragua location."

Thus the doctors disagree, the great element of uncertainty being the tunnel. If this be only 4 or 5 miles long, is not San Blas the best route?

As to Geographical Position.—About 94 per cent. of the population of the world inhabit countries lying north of the latitude of the projected Nicaragua and Panamá canals. It may be difficult to show that any large proportion of the southern 6 per cent. are commercially interested in the realization of either project. It is generally supposed that the isthmus of Panamá occupies as commanding a trade position as that of Suez; but the parallel of latitude of Suez (30°) cuts through or runs in the neighbourhood of the densest area of population of our globe. Hundreds of millions of Asiatic people, at the eastern doorway of Suez, are constantly exchanging their products for those of Europe lying at the Mediterranean entrance, and yet the shipping passing along this very ancient highway does not yet reach ten millions of net tons yearly.

In estimating the advantages of the Nicaragua or the Panamá canal to the general trade of the world, the following tables of distances seem important. They are in nautical miles, and each case represents the distance which a full-powered steamship has to sail from her port of departure to her destination. It does not appear necessary to give a similar table of routes taken by sailing ships, for they will probably be very little used for voyages through any interoceanic canal:—

	Miles.
Plymouth, England, to Panamá	4580
New York „	2021
New Orleans „	1420
Panamá to Acapulco	1437
„ San Francisco	3277
„ Esquimalt	3840
„ Guayaquil	842
„ Callao	1337
„ Iquique	1999
„ Valparaiso	2608
„ Punta Arenas, in Straits of Magellan	3932
„ Tahiti	4530
„ Apia	5739
„ Honolulu	4665

Viâ STRAITS OF MAGELLAN.

	From New York.	From Plymouth.
To Rio de Janeiro	4778	5130
„ Montevideo	5768	6110
„ Punta Arenas	7035	7350
„ Valparaiso	8460	8775
„ Iquique	9220	9535
„ Callao	9701	10,016
„ Panamá	10,967	11,282
„ San Francisco	13,234	13,549
„ Esquimalt	13,920	14,235

TO ASIATIC COAST AND ISLANDS.

	Miles.
From San Francisco to Honolulu	2100
„ „ Yokohama	4536
„ „ Shanghai	5550
„ „ Hong Hong	6086
„ „ Manila	6254
„ „ Sydney	6514
„ „ Singapore	7330
Honolulu to Yokohama	3400
„ Hong Kong	4961
„ Guam	3337
Guam to Manila	1506
Manila to Singapore	1386
Tahiti to Sydney	3300

DISTANCES FROM NEW YORK AND PLYMOUTH *viâ* STRAITS OF MAGELLAN AND *viâ* CAPE OF GOOD HOPE.

From New York	*Viâ* Straits.	*Viâ* Cape.		*Viâ* Straits.	*Viâ* Cape.	from Plymouth.
	12,896	12,670	to Melbourne	13,211	11,870	
	12,693	13,140	„ Sydney	13,008	12,340	
	11,413	13,710	„ Wellington	11,728	12,910	
	16,815	13,530	„ Manila	17,130	12,736	
	16,696	12,150	„ Singapore	17,011	11,350	
	17,132	13,590	„ Hong Kong	17,447	12,790	
	17,009	14,340	„ Shanghai	17,324	13,540	
	16,284	15,020	„ Yokohama	16,599	14,220	

PANAMÁ ROUTE TO COAST OF ASIA AND ISLANDS OF THE PACIFIC OCEAN *versus* SUEZ CANAL ROUTE.

	Viâ Panamá.	*Viâ* Suez.		*Viâ* Panamá.	*Viâ* Suez.	
From New York	10,016	12,790	to Melbourne	12,575	10,670	from Plymouth.
	9,851	13,320	„ Sydney	12,410	11,200	
	8,533	14,230	„ Wellington	11,092	12,110	
	11,521	11,556	„ Manila	14,080	9,436	
	12,915	10,170	„ Singapore	15,474	8,050	
	11,603	11,610	„ Hong Kong	14,162	9,490	
	11,726	12,360	„ Shanghai	14,285	10,240	
	10,086	13,040	„ Yokohama	12,645	10,920	

NOTE.—All of the above distances are taken from 'Tracks for Full-powered Steam-vessels, with the Shortest Navigable Distances in Nautical Miles,' published by the United States Hydrographic Office, 1900, and from the Admiralty chart of 1888. Some discrepancies exist between them, which I have carefully adjusted.

It is obvious that the primary reason for cutting an American maritime canal is to save *distance;* therefore no objection can be urged if we take *distance* as the basis for estimating its advantages to the commercial world. In consequence, it appears justifiable to eliminate from its influence those countries the ships of which can find shorter routes for their voyages than the one *viâ* Nicaragua or Panamá. Having in this manner reduced the area from which the canal may draw its traffic, we may then roughly estimate what part of the trade tonnage of that area it may hope to obtain. Thus reasoning, and keeping in view the above distance tables, we may at once eliminate the whole inter-commercial movement between Europe, Asia, and Africa. The distance from Plymouth to Singapore by Suez is 7424 miles less than *viâ* Panamá, and 1725 miles less to Yokohama. Indeed, Plymouth is 745 miles nearer to Shanghai by way of the Cape of Good Hope than by a Panamá canal route. Thus *distance* says that for the inter-trade of Europe, Asia, and Africa a Panamá canal will be useless. Almost the entire tonnage and revenues of the Suez canal are derived from that trade. Hence to estimate the probable traffic of a Nicaragua or a Panamá canal at several million tons, simply because the Suez canal shows about ten million net tons of shipping, from the sources indicated, does not appear to be logical.

We may further eliminate from control of the Panamá canal all trade between Europe and Australia, Sydney being about 12,410 miles distant from Plymouth by the Panamá route, and 11,200 by Suez. Wellington, New Zealand, is 11,728 miles *viâ* Straits of Magellan, and only 636 miles less *viâ* Panamá—a difference which would be cancelled by the canal tolls.

The analysis, thus far, seems to eliminate from the influence of the Panamá canal the whole inter-trade of by far the greater part of the land surface, and over nine-tenths of the population of the globe. Our

inquiry is thus narrowed, so far as the Old World is concerned, to the attractions which an American canal may have for European trade with the Pacific side of the Western Continent. In this, however, it is evident that the canal tolls will, to a considerable extent, be a governing factor.

With the traffic problem limited, we may now proceed to study the commercial movement of the west coast of South and North America. Of the continental drainage of the former, 89 per cent. finds its way to the Atlantic ocean, and 6 per cent. to the Pacific, 5 per cent. being absorbed by the thirsty inter-Andean section. From Panamá to southern Ecuador, the Pacific slope of the Andes is a dense, almost impenetrable jungle. Then commences the dry desert, which extends to 33° S. lat. The height of the Andean passes * forbids their becoming the trade avenues of any important part of the east slope of the Andes, and thus, south of Panamá as far as the Straits of Magellan, foreign commerce must consist almost entirely of the imports and exports of the small area of South America which drains into the Pacific ocean.

Numerous attempts have been made to estimate approximately the probable traffic of a Panamá canal. They have been based almost wholly upon official statistics of tonnage entrances and clearances of ships. It is this method which has so swollen the estimates, and given results which are unreliable. Take, for instance, the commerce of the west coast of South America—counted in this way it is gigantic. The coasting trade is done by foreign steamships, and a single 2000-ton vessel, running from Panamá to Valparaiso, and, during every trip, *entered* and *cleared* perhaps at a dozen ports, picking up or discharging a few tons of freight at each, may add yearly 200,000 to 300,000 tons of *entrances and clearances* to the commercial record. So also with the Central American states and Mexico; the little port of Punta Arenas, in Costa Rica, shows a movement of 323,000 tons, although its actual import and export trade is only about 12,000 tons. Thus millions of tons of traffic, heretofore credited to a canal, represent the cargoes of "Flying Dutchmen." In fact, an analysis of its probable traffic is one of the most hallucinating of problems. It involves a knowledge of the weight of all exports and imports; and the Pacific coast countries, except in one or two uncertain cases, give no weights of goods, only their valuation for customs purposes; thus one is almost invariably obliged to fix an average cash value per ton on both exports and imports to arrive at the approximate tonnage; and, if disposed to take an exaggerated view of the traffic possibilities of a canal, may swell them to almost any figure. Then, also, the steamship *versus* the sailing ship

* "South America: An Outline of its Physical Geography." By G. E. Church. *Royal Geo. Soc. Journal*, April, 1901.

has to be considered, the varying net register of ships in comparison to cargo capacity, trade winds, ocean currents, coaling-stations and cost of coal, seasons when products of various countries are in most demand and require the most rapid means of transportation—these and other uncertain factors of importance are involved in the vexed problem. Thus men of marked ability and good faith who have tried to solve it constantly change their figures, as Lesseps did up to the collapse of his Panamá company, and as the private American companies which have attempted a Nicaragua canal have done. Thus, presenting weapons to any expert who may wish to challenge my estimate, I offer the following:—

South American Trade upon which an American Interoceanic Canal must depend.

		Imports. £	Exports. £
1900	Chile	9,640,360	12,575,598
1899	Peru	2,106,640	3,361,520
1898	Ecuador	1,000,000	1,257,978
1900	Nicaragua	703,490	792,203
1899	Honduras	280,803	231,014
1900	San Salvador	600,000	914,269
1898	Guatemala	900,000	1,674,009
1899	Mexico	272,289	726,393
		15,503,582	21,532,975

The general value of Spanish American imports on the Pacific coast, I calculate at the rate of £25 per ton. The exports vary in value according to the countries. Coal is reckoned at a separate valuation. The ton of merchandise is taken at 2240 lbs. in all cases.

Chile.

	Imports		£9,640,360
Deduct coal	674,746 tons, value		1,012,000
			£8,628,360 =
	345,134 „ at £25		
Total imports ...	1,019,880 „		

Deduct 523,209 tons of coal and goods from Pacific ocean countries, and we have 496,671 tons of cargo for North Atlantic ports. But it must be borne in mind that the distance between Europe and Valparaiso is but 1587 miles greater by way of the Straits of Magellan than by the Panamá route, and that eight-tenths of the imports of Chili enter through Valparaiso and ports to the south of that principal emporium of the country.

Exports		£12,575,598
Actual tonnage of nitrate, 1,389,000 tons at £6	= £8,334,000	
Exports to Pacific coast countries, Argentine and Brazil	950,000	
		9,284,000
		£3,291,598 =

164,579 tons at £20 for North Atlantic

For Chile, therefore, we have—

Imports	496,671 tons
Exports of nitrate	1,389,000 „
„ merchandise	164,579 „
Total North Atlantic trade	2,050,250 „

The "Permanent Nitrate Committee," of London, has kindly informed me "that 76·14 per cent. of the nitrate tonnage is carried by sailing ships, and, although the percentage by steamers is gradually increasing, sailing ships will continue to have the preference (except to load in the first three months of the year for season arrival) as long as suitable ships continue to be built. Freight by steamer is from one to two shillings per ton higher than by sail. In the nitrate trade a ship's cargo is generally about 60 per cent. greater than the registered tonnage. Sailing craft average ninety-eight days for the voyage from Peru to England, and steamers, fifty-six days.

"The largest quantity of nitrate is shipped in the months of October, November, and December. There is much diversity of opinion among experts as to the life of the nitrate beds, but it is believed that there will be no rapid decrease in output for the next twenty years."

The Pacific coast trade of Bolivia is credited to Peru and Chilé, across which countries it passes.

PERU.

Imports		£2,106,640
From China and Pacific coast	£440,547	
By way of Iquitos on Amazon	233,155	
		673,702
		£1,432,938 =

57,316 tons at £25

Exports		£3,361,520
To Pacific countries and from Iquitos		993,804
		£2,367,716 =

236,772 tons. at say £10

From Peru, therefore, we have—

Imports	57,316 tons
Exports	236,772 „
Total North Atlantic trade	294,088 „

Ecuador.

Estimated *Imports*, £1,000,000

There are no statistics for a recent year, but the value of imports at Guayaquil for the first six months of 1898 was £434,465, representing the goods entered and actually weighed at the custom-house, the official weight being 16,880 tons. This makes the average value over £25 per ton, and thus, in some measure, confirms my estimate of the general value of imports before examining into the trade of Ecuador. It is probably excessive to fix the yearly imports of that country at 40,000 tons.

	Exports	£1,257,978
To Chili and Peru	... ...	121,127
		£1,136,851 =

22,737 tons, at say £50

For Ecuador, therefore, we have—

Imports	40,000 tons
Exports	22,737 „
Total North Atlantic trade	62,737 „

Colombia

has no trade with the North Atlantic worth mentioning through her Pacific coast ports. Panamá is simply a land transit, not to be taken into account when estimating the interchange of goods between countries. Some canal-tonnage estimates erroneously include the traffic of the Panamá railway.

Costa Rica.

Pacific coast imports and exports (estimated) ... ... 12,000 tons

Nicaragua.

	Imports	£703,490
Deduct for Atlantic side	... ...	200,000
		£503,490 =

20,100 tons at £25

	Exports	£792,203
Less gold, silver, and Atlantic coast	... ...	262,850
		£529,353 =

8822 tons at £60

For Nicaragua, therefore, we have—

Imports	20,100 tons
Exports	8,822 „
Total North Atlantic trade with Pacific coast ...	28,922 „

Honduras.

The import and export data are confused, but the *Imports* are about—

		£280,803
On Atlantic side	£80,803	
From Pacific coast	1,500	
		82,303
		£198,500 =

8000 tons at £25

Exports		£231,014
From Atlantic side	£117,743	
Gold and silver	67,484	
		185,227
		£45,787 =

2289 tons at £20

For Honduras, therefore, we have—

Imports	8000 tons
Exports	2289 „
Total North Atlantic trade with Pacific coast ...	10,289 „

Salvador.

Imports	£600,000 = 24,000 tons at £25
Exports	£914,269 = 30,475 „ £30

This credits all the trade to the North Atlantic, although a proportion is due to the Pacific coast countries.

For Salvador, therefore, we have—

Imports	24,000 tons
Exports	30,475 „
Total North Atlantic trade	54,475 „

Guatemala.

Imports	£900,000 = 36,000 tons at £25
Exports	£1,674,000 = 47,830 „ £35

This also credits the whole trade of Guatemala to the North Atlantic, although it does not belong to it entirely. The value of the coffee of Guatemala exported was £1,478,096.

For Guatemala, therefore, we have—

Imports	36,000 tons
Exports	47,830 „
Total North Atlantic trade	83,830 „

Mexico.

The financial agent in London gives me the latest statistics which he has for the trade of the west coast (Acapulco, Manzanillo, San Blas, Mazatlan, Guaymas, and La Paz) for the year 1896.

Imports	£272,289 =	10,912 tons at £25
Exports, including silver	£726,393 =	18,160 „ £40

For Mexico, on the west coast, the trade varies but little. It is probably an excess to give—

Imports for 1900	12,000 tons
Exports	20,000 „
Total for North Atlantic trade	32,000 „

Although some of this tonnage is due to California.

California.

San Francisco imports				£8,128,749
Of this: 120,000 tons cement				197,764
142,500 „ common goods at £15				2,137,338
909,300 „ coal				1,406,134
Balance				4,387,513 =
115,000 „ high-class trans-continental goooods at £38				
Total 1,286,800 „ total value				£8,128,749
Total tonnage imports				1,286,800 tons
Deduct coal from British Columbia		573,600 tons		
„ „ Australia		179,800 „		
„ „ others		52,600 „		
„ sundry high-class goods		115,000 „		
„ China and Japan cement		1,800 „		
				922,800 „
Total for North Atlantic trade				364,000 „
Exports, not including £3,123,954 treasure ...				£7,949,012
Of which to Europe				2,928,606 =
585,721 tons at £5				
Add 4,758 „ for United States and east coast, all sea-route				
„ 73,890 „ *viâ* Panamá				
Total 664,369 „				

For San Francisco, therefore, we have—

Imports	364,000 tons
Exports	664,369 „
Add for San Diego and Los Angeles imports and exports	20,000 „
Total North Atlantic trade by sea	1,048,369 „

Oregon and Washington.

Imports.

At Portland	£531,458
Of this from Pacific countries	461,191
	£70,267 =

7027 tons at £10

Exports	£1,801,072
Trade with Pacific	548,286
Trade with United Kingdom	£1,252,786 =

313,196 tons at £4

Imports of *Puget sound* customs district from Europe, say 15,000 tons at £10 = £150,000
Exports to „ 140,465 „ £4 = £561,858

The remaining trade is with Pacific countries. For Oregon and Washington, therefore, we have—

Imports and exports of Portland	320,223 tons
„ „ Puget sound	155,465 „
Total North Atlantic trade by sea	475,688 „

British Columbia.

Import and export trade with North Atlantic *viâ* Cape Horn, estimated 75,000 tons.

Hawaii.

Imports	£3,800,000
From United States west coast	1,831,000
	£1,969,000 =

98,500 tons at £20
Deduct 13,100 „ Asia and Pacific islands

Leaves 85,400 „

Exports	£4,525,000
To west coast of United States	2,320,000
	£2,205,000 =

147,000 tons at £15

For Hawaii, therefore, we have—

Imports	85,400 tons
Exports	147,000 „
Total for North Atlantic trade	232,400 „

Polynesia.

The imports and exports of the several islands, not including Fiji, are valued at about £265,000. It is probably an excess to allow 20,000

tons for their North Atlantic trade. That of Fiji is almost wholly with Australia.

TRADE OF THE UNITED STATES WITH THE ASIATIC PACIFIC COAST.

Imports.

Japan		£6,544,884
China		5,379,223
Hong Kong		251,251
Asiatic Russia		202
Of this total		£12,175,560
California receives	£4,298,103	
Portland „	88,100	
Puget sound ports receive	1,825,663	
		6,211,866
		£5,963,694

Which amount mostly represents goods of secondary value, say, £25 per ton = 238,547 tons

Exports.

From the United States to—		
Japan		£5,817,528
China		3,051,749
Hong Kong		1,697,198
Asiatic Russia		610,050
Chinese Russia		67,462
		£11,243,987
From which deduct for California ...	£2,250,000	
„ „ Portland	419,800	
„ „ Puget sound ports	1,870,000	
		4,539,800
		£6,704,187

Of this amount, take half at the average tonnage value of £40 = 83,800 tons
And half „ „ „ £20 = 167,600 „
Total ... ... 251,400 „

For trade of United States with the Asiatic Pacific coast, we therefore have—

Imports	238,547 tons
Exports	251,400 „
Total	489,947 „

for the east coast trade of the United States, all sea-route.

It may be appropriate to call attention here to the hallucination which exists regarding the foreign trade of the people of China, and the anxiety of the Western nations to secure it at any cost, as if dense population were the measure of commercial possibilities. Compare China with its 400,000,000 inhabitants with the Argentine Republic and Chile, aggregating but 8,000,000; China has a total foreign trade

of £69,320,000, and the two other countries £80,556,000. China gives 3*s.* 6*d.* per head, and the Argentine and Chile average a trade of £10 per head—the difference between the inertia of old age and the activity of youth.

The PHILIPPINE ISLANDS—the last colonial curse of Spain—now transferred to the United States.

Imports from the United States	£270,000	
Exports to „	808,000	
The former at £20	=	13,500 tons
The latter at £15	=	54,000 „
Total	67,500	„
Deduct for California trade	12,000	„
Leaves for east coast trade of United States ...	55,000	„

The tables of distances do not warrant the supposition that any of the commerce of Europe with Australia and New Zealand can be diverted from the routes it takes at present; therefore our inquiry regarding those countries is confined (as in the case of the Philippine islands) to the trade which the United States has with them.

TRADE OF AUSTRALASIA WITH THE UNITED STATES.

	Imports.	Exports.
New South Wales	£2,557,961	£3,981,242
Victoria	1,323,757	235,012
South Australia	350,860	900
New Zealand	775,309	457,875
Totals	£5,007,887	£4,675,029
Of the *imports*		£5,007,887
New South Wales imports from west coast of United States, say	£300,000	
Victoria (Government Report)	71,485	
South Australia, say	50,000	
New Zealand (Government Report)	87,403	
		508,888
		£4,498,999 =
112,475 tons at £40		
Of the *exports*		£4,675,029
Those from New South Wales include gold	£3,701,156	
And coal to west coast of United States ...	66,094	
		3,767,250
		£907,779 =
22,695 tons at £40		

We therefore have of Australasian trade with the east coast of the United States—

Imports	112,475 tons
Exports	22,695 „
	135,170 „

Summary of tonnage upon which a Panamá canal would have to depend for traffic were the canal open to-day.

	Tons.
Chile	2,050,250
Peru	294,088
Ecuador	62,737
Costa Rica	12,000
Nicaragua	28,922
Honduras	10,289
Salvador	54,475
Guatemala	83,830
Mexico	32,000
California	1,048,369
Oregon and Washington	475,688
British Columbia	75,000
Hawaii	232,400
Polynesia	20,000
Asiatic-Pacific coast	489,947
Philippines	55,000
Australasia	135,170
Total	5,160,165

When we consider that, of the nitrate trade of Chile, 1,057,584 tons are carried by sailing craft, that the exports of the west coast of North America to the United Kingdom are nearly all by sail, and that the remaining countries of the above list have a large trade by sailing ships, it seems reasonable to estimate that at least fifty per cent. of the commercial cargo tonnage indicated is carried by sailing craft. Were there a strait, *without toll charge*, connecting the two oceans at Panamá, would these ships take that route? The evidence regarding sailing conditions is of such a nature that no prudent man would, for the purpose of estimating the value of the projected canal as a commercial venture, take into account the tonnage of sailing ships engaged in the trade of the countries interested in it. Even the "Isthmian Canal Commission" in its report just presented to the United States Government, although it includes the sailing-ship tonnage in its estimate of canal traffic, says: "The Nicaragua route would be the more favourable one for sailing vessels," which, however, "would probably be unable to compete with steamers to any considerable extent by either canal. They would certainly be unable to compete with steamers, both using the Panamá canal." In other words, send your freight by steamship if you wish to use the canal. But suppose you do not wish to use it? The report preserves a discreet silence as to whether the Commission believes that sailing craft can be counted on to use the canal at all.

My estimate of cargo tons upon which a canal would have to depend, carried to-day by sail and steamer, is 5,160,165 tons, from which it seems proper to deduct half for the sail-tonnage, 2,580,082, leaving 2,580,082

cargo tons, to which a canal must look for traffic. But how much of this can the canal count upon with certainty? This is a question that no one can answer even approximately. Although a steamship may find the canal route the shortest possible for her voyage, there is only a hopeful possibility that she will take it, for there are other factors in the problem which may govern her choice of route, so well known to the shipping world that it is not necessary to occupy space in their discussion. For instance, in 1878, the tonnage which passed through the Suez canal was 2,269,678 tons net, while the tonnage then believed to be tributary to the canal was, according to the United States Bureau of Statistics, 6,312,742 tons. Thus the canal got 36 per cent. only from its apparently tributary traffic. But let us be generous to so magnificent an enterprise as an American isthmian canal, and assume that it will get 70 per cent. of the apparent steamer traffic, or 1,806,058 cargo tons. Then comes the question what is a cargo ton in relation to the net register ton of a steamship? the latter being the class of measurement adopted by the Isthmian Canal Commission in its estimate of canal tonnage for purposes of toll. It is well to state that there is a special Suez canal tonnage measurement, on which the company collects its nine francs per ton toll for all ships making the transit of the canal. As this is important, I give it in connection with the tonnage of the following ships, which are average examples of modern freighting steamers:—

Name of ship.	Gross tons.	Net.	Suez tons.	Cargo capacity.
Cheltenham	3741	2415	2756	6000
Shrewsbury	3223	2079	2828	5400
Winchester	3237	2087	2493	5400
Rugby	3286	2110	2854	5400
Charterhouse	3021	1928	2528	4900
Repton	2881	1852	2164	4328
Anglo Chilian	3817	2441	2924	6000
South America	4197	2701	3930	7300
Juanita North	3503	2233	2737	5660
Total	30,906	19,846	25,214	50,388

The average cargo capacity of these steamships is, therefore, about two and a half times their net tonnage; but if the Suez measurement be adopted, it is just twice; but the cargo capacity is dead weight, and includes coal-bunker space. If the cargoes be general measurement goods, the ships will carry more than their full cargo tonnage capacity plus coal. Thus, in estimating the ship tonnage, and including a few ships in ballast or with partial loads, it may fairly be conceded that every net register ton of steamships will carry two cargo tons.

THE RESULT OF THE ANALYSIS is that the portion of existing traffic which a Panamá canal may possibly attract (1,806,058 cargo tons) will require 903,029 net register tons of steamships.

The Isthmian Canal Commission recommends a "net register" toll of $1 per ton; but states that the cost of maintenance of the Panamá canal will be $2,000,000 yearly, and of the Nicaragua, $3,300,000.

Of course, much depends upon the growth of commerce of the countries bordering the Pacific ocean during the ten years' cutting of the canal. That growth may be important, but is it not over estimated? What has it been on the Caribbean sea side of the canal during the past four centuries? When the estimates for the old Panamá Canal Company were made in 1879, the Congress fixed the tonnage at 5,250,000 "très hypothétique," and therefore "prudently reduced" it to 4,838,000 tons; but calculated that upon opening the canal in 1889 the increased commerce of the world would give the canal 7,249,000 tons net register. Thus the same delusive argument prevailed then as now regarding growth of traffic. Thirty years have elapsed since Lesseps held his congress, and now we have the estimate of the Isthmian Canal Commission, giving the canal 4,574,852 tons net register, and stating that the new Panamá Canal Company estimates the tonnage at 4,685,575 tons. What has become of the continuous increment since Lesseps' original estimate?

After an elaborate report of the highest scientific value, which does great honour to the engineering talent of the United States, the Isthmian Canal Commission seems to convey the impression that it would have been thankful if chapter ix. on the "Industrial and Commercial Value of the Canal" had been entrusted to a body of gentlemen less tied to accurate analysis, and a knowledge of the value of words. How keenly it realizes the illusory nature of its tonnage estimate is evident from the following statement in its report:—"The commerce of western South America with Europe will continue to pass the Straits of Magellan, or to round Cape Horn; the trade of the American Atlantic seaboard with Australia will keep to the Good Hope route, and the traffic between our eastern seaboard and the Philippines and southern China will remain tributary to the Suez route if the charges for passing the American canal are made greater than the saving to be effected by using that waterway. A toll of about $1 per ton net register could probably be paid by the commerce between Europe and western South America, and by that of our eastern seaboard with Australia; a much higher charge would probably cause a large share of the business to continue to be done by the routes now used. For the commerce of our eastern ports with the Philippines and the main land of Asia between Singapore and Shanghai, the distance by way of the Suez and Isthmian canals will be so nearly equal that the route will depend largely upon tolls. Light charges at the American canal will give that waterway a

large share of the tonnage; high tolls will cause the Suez route to be used."

The report of the Commission (minus appendix)* only generalizes the traffic estimates, giving 6,702,541 cargo tons. One may be allowed to express surprise that *net tonnage* in 1899 "was ascertained by an examination of the statistics of *entrances* and *clearances* kept by the United States and European countries, and included 336,998 tons for the commerce now crossing the isthmus of Panamá." This *net register* vessel-tonnage for the Panamá railway for 1899 is so widely at variance from 'Poor's Manual,' which gives 287,400 ordinary *gross* tons for that year, that the discrepancy merits attention.

The Commission says that its total traffic estimate "was compared with the investigation made by the New Panamá Canal Company. *The records of vessel movements kept by that company*" (the italics are mine) "show a traffic, for the calendar year 1899, of 3,848,577 tons net register for the commerce between Europe and the Western coast of the American continent, between the Atlantic seaboard of America and trans-Pacific countries, and between the two American seaboards. The total obtained from *the records kept by the Panamá Company* does not include any vessel-tonnage for the commerce now crossing the isthmus. The addition of that tonnage, 336,998 tons, raises the total to 4,185,575."

One gathers, from this statement, that the New Panamá Canal Company has kept a special "*record of vessel movements*" during the year mentioned. But the Commission has been misinformed, or, perhaps, has misinterpreted the information given to it. The Panamá Canal Company informs me that its estimate is derived from "le dépouillement de très nombreux documents de statistique"—abstracts from very numerous statistical documents—which is the procedure which has been adopted in all canal traffic estimates since that made by Lesseps.

Would it not be desirable to have something more definite than the following item in the Report of the Commission: "The entrances and clearances of New Zealand's trade with North-Western Europe amounted to 481,178 tons, net register in 1899, and the European commerce of the other islands east of Australia to 181,743 tons. Of this total traffic of 662,921 tons, 500,000 might have advantageously used an isthmian canal, and this should be added to the canal tonnage originating or terminating in America. This makes the total obtained by the Commission's investigation of the tonnage that might have used an isthmian canal, in 1899, 4,574,852 tons net register; and the total

* I learn that the appendix to the report of the Commission cannot be completed for several months yet. This appears to postpone canal legislation at Washington; for no prudent legislative body, even with the overflowing treasury of the United States behind it, can afford to launch forty to fifty million sterling into Panamá or Nicaragua without a keen analysis *in detail* of the generalized estimates of traffic.

obtained by adopting the New Panamá Canal Company's figures, originating or terminating in America, 4,685,575 tons." It is notable that the estimate of the Canal Company itself is 3,848,577 tons, and that the Commission adds to it the Panamá railway traffic and 500,000 tons, which, in its opinion, north-western Europe may send through the canal in the New Zealand trade. The report absorbs every vessel which, in its voyage, might, on the basis of distance, "have advantageously used the canal." Does the Suez canal, to-day, show a traffic tonnage on the same hypothesis? I sympathize with the Isthmian Canal Commission. Only monastic patience and mathematical talent impervious to offence, can wade through the voluminous, frequently overloaded and often contradictory and erroneous trade statistics of the world, and derive from them any satisfactory result. In the "Preliminary Report" of the Commission, November 30, 1900, I find that, after an exhaustive study of the commerce of the world, it is estimated that it will give the canal net-register tons 5,736,456. The final report reduces this figure to 4,574,882—that is to say, by no less than 1,161,574 tons. It is to be regretted that the estimates are so wavering.

The "Preliminary Report" says, "The statistics of exports and imports of all countries being given in values or quantities, it was necessary to convert these into their tonnage equivalents." Here we are agreed, but why did the Commission abandon this only legitimate basis for an estimate, and resort, in the final report, to the *ignis fatuus* one of "*entrances* and *clearances*" of vessel tonnage?

The most elaborate, voluminous, and careful Isthmian canal traffic estimate, on this basis, which I have seen was that made in 1880, by the United States Bureau of Statistics, under the very intelligent direction of Mr. Joseph Nimmo, jun. Even thus, his "Proposed American Interoceanic Canal in its Commercial Aspects" could find only 1,625,000 tons to credit to the canal from the world's commerce.

For the sake of brevity, I have largely confined my estimate to Panamá, but if Nicaragua be the route adopted, the tonnage conceded must be reduced, because, for most of the general merchandise trade of Chili, it will turn the scales in favour of the Straits of Magellan.

Against the disadvantage of a canal with locks, recommended by the Commission, whether across Nicaragua or Panamá, the depth of water throughout is to be 35 feet. This, taking into consideration the increasing size and draft of ships, will, of course, give an American canal great advantages in competition with Suez for the trade of the Pacific coast of Asia and adjacent islands; but is it supposable that the Suez Canal Company will allow its control of trade to escape for want of dredging? The maximum draft of ships permitted in the canal, since April 15, 1890, is 25 feet 7 inches.

In considering the tonnage which will use an American canal, coal

becomes a factor of importance, and perhaps, in some cases, it is master of geographical position. The best bunker coals are Cardiff, Tyne, Newcastle (in New South Wales), and Pocahontas or New River, shipped at Norfolk and Newport, Virginia. Poorer descriptions are found in India, Japan, and Chile, not at all comparable to those mentioned. The west coast of the United States is supplied with excellent coal from Australia, Wales, British Columbia, Seattle, Tacoma, Mount Diablo, Coos Bay, Tesla, and Rocky mountains.

For Suez canal voyages, the following are approximate prices for annual coaling contracts at Port Said, Colombo, and Singapore, 1897 to 1902:—*

	1897.		1898.		1899.		1900.		1901.		1902.	
	s.	*d.*	*s.*	*d.*	*s.*	*d.*	*s.*	*d.*	*s.*	*d.*	*s.*	*d.*
Port Said, Welsh ...	18	0	20	6	24	6	26	0	29	0	24	0
Colombo, „ ...	30	0	27	6	31	0	35	6	45	0	30	0
„ Bengal ...	21	0	20	6	22	6	23	0	23	0	20	0
Singapore, Welsh ...	35	0	35	0	32	6	38	0	46	0	37	6
„ Japan ...	19	6	26	0	24	0	26	0	27	0	25	0

"With regard to Colombo and Singapore, the largest and fastest steamers take Welsh coal as a rule, but some, at Singapore, take the best description of Japan coal, paying sometimes a shilling or two above the prices given, in order to secure best possible descriptions. Ordinary steamers take Bengal coal at Colombo, and ordinary best Japan at Singapore."

The price of Japanese coal at Hong Kong is 22*s.*; at Shanghai, 20*s.*; and at Yokohama, 19*s.*

The price of coal in Oregon at tide water is about 12*s.* per ton; at Vancouver, 19*s.*; at Esquimalt, 23*s.*; Victoria, 23*s.* At San Francisco, during 1890, the best Australian averaged from 27*s.* to 30*s.*, but the growing output of the mines of British Columbia, Oregon, and California promises, within a few years, to supply the entire wants of the Pacific coast of North America. Coronel (Chile) coal is of very poor quality, and averages about 20*s.* per ton as against 40*s.* for Pocahontas or Welsh. At Honolulu, Australian coal is about 48*s.* per ton, Seattle 40*s.*, and British Columbia, which is of very fine quality, 52*s.* New River steam coal, Virginia, is 13*s.* at Newport News, 28*s.* at Colon, and 38*s.* at Panamá. By these prices the comparative coaling cost of a voyage *viâ* Suez or *viâ* Panamá may be approximately estimated.

The average speed of a cargo ship is about 9 knots an hour, and the following example of a voyage is interesting:† Steamer *Straits of Menai*, 6200 cargo tons, speed about 9 knots, voyage recently made from United Kingdom to Amoor river, Japan, Puget sound, Coronel, Straits of

* I am indebted to Messrs. Hull, Blyth & Co. for preparing this table for me.

† By the courtesy of Messrs. Munn, George & Co.

Magellan, Cape of Good Hope, Delagoa bay, Cape of Good Hope, Buenos Ayres, and home. Consumption of coal per day was: Scotch, 16 tons 9 cwt.; Welsh, taken abroad, 15 tons 2 cwt.; Japanese, 17 tons 7 cwt.; British Columbia, at Puget sound, 18 tons 9 cwt.; Coronel, 20 tons. The above is a practical demonstration of the relative value of the different coals mentioned, for steam purposes.

My finding of the problematical traffic of an American interoceanic canal is 903,029 tons, net register, on the basis of the world's commercial movement to-day. What is the principal reason that it is problematical?

To answer this pertinent question, an inquiry into the relation which the projected canal will bear to the Pacific railways of the United States and Canada is important. When the 47½ miles of the Panamá railway were opened to traffic, January 28, 1855, there was not so great a length of railway west of the Mississippi river. Now there are seven trans-continental lines which reach the Pacific coast. The first one, the Union and Central Pacific, was, with a divine faith in the solidarity of the country, pressed to completion during the great Civil War, and opened to traffic from New York to San Francisco, May 10, 1869. The first whistle of the locomotive called the trade between the Atlantic and Pacific states to abandon the Panamá and Cape Horn routes, and take the trans-continental one. In 1869, the interchange of trade between New York and San Francisco *viâ* the Panamá railway was valued at £14,040,000. In 1870 it dropped to £3,720,000, and in 1879, by continuous decrease, had fallen to £990,000. These figures include treasure £3,230,000 in 1869, and only £43,300 in the year following. The Panamá railway had evidently lost its control of interoceanic communication; man had discovered how to turn and make of quite secondary value one of the most commanding geographical positions on the globe—one from which, for three centuries, Spain had directed the commercial destinies of two-thirds of the Western Continent and the whole eastern shore of the Pacific ocean. If the effect of the trans-continental railways on the traffic across Panamá was disastrous to the Panamá railway, it was annihilating to that between the Pacific and Atlantic coasts *viâ* the Cape Horn route. In 1869, a magnificent fleet of clipper ships carried on this commerce; they have disappeared! In 1900, the Panamá railway showed a movement of 357,377 tons of freight; not so much as in 1888.

The tonnage transported by the following named Pacific railways for 1900, *according to* '*Poor's Manual*,' *was*—

By the	Atchison, Topeka, and Santa Fé	9,893,018
„	Missouri Pacific	11,126,275
„	Northern „	7,121,655
„	Great Northern Pacific	5,162,757
„	Southern Pacific	15,256,989
	Total tons	48,560,698

This tonnage, 136 times that of the Panamá railway, includes the local and through traffic which has been called into existence west of the Mississippi river since the Panamá railway was built. To this we may add the traffic of the Canadian Pacific, 7,155,813 tons, over twenty times that of the Panamá line. These avenues of commerce are different from those of ocean-borne trade; they ramify in countless directions; every city, town, and hamlet draws life and vigour from them; thousands of stations along their routes serve as distributing points from which branches lead to minor centres. This vast system of communications may be likened to a fisher's net spread across the continent and from the Gulf of Mexico to Lake Winnipeg, with every mesh teeming with active life and trade possibilities, and interested in the welfare of every other mesh. What a commerce! In comparison to this picture, what is the ship and her ocean avenue? There are no distributing and receiving points for cargo at every mile of her voyage; on the contrary, she is a medium of through traffic only; the ocean waste is not a feeder of her powers, but a severe tax upon them; she leaves a port, and, after many days, reaches another, and all is loss in the interval; as she ploughs her way through the waters, they close in behind her, and are again as they were a million years ago. This is the transportation means upon which our United States Government counts to do battle with the Pacific railways for trans-continental and Pacific ocean trade when an American canal is cut.

When an interoceanic canal began to be seriously discussed in 1870, the people of the United States had not found a satisfactory *modus vivendi* with the railways. Only recently have the interests of both become harmonious, the railways finally bending to the necessities of the country as regards traffic rates. I am indebted to the "Interstate Commerce Commission" for the following traffic rates at present ruling per ton-mile, in comparison to those of 1870:—

	1870.		1900.
Lines east of Chicago	1.61 cents	...	0.55 cents
West and north-west lines	2.61 „	...	0.89 „
South-west lines	2.95 „	...	0.91 „
Southern „	2.39 „	...	0.63 „
Trans-continental lines	4.50 „	...	0.93 „

These rates are the average for the entire traffic of each set of lines.

The following are the through rates for all classes of goods from San Francisco across the continent:—

CLASS RATES IN CENTS PER 100 LBS.

	1	2	3	4	5	A	B	C	D	E
From San Francisco to New York	370	330	265	210	185	185	165	130	115	105
From San Francisco to New Orleans	320	280	230	185	165	167	148	115	100	90
From San Francisco to Galveston	300	260	220	180	160	160	140	110	95	85

Among certain articles not classified are canned goods, beans, and dried fruits. The rates are the same on these articles from San Francisco to New York, New Orleans, or Galveston—canned goods and beans 75 cents per 100 lbs., and fruit $1. It is thus seen that the railways are already able to carry certain goods across the continent for $16.80 per gross ton. The distances are—

From San Francisco to New York	... ...	3267 miles
„ „ New Orleans	... ...	2454 „
„ „ Galveston	... ...	2156 „
„ Vancouver to Montreal	... ...	2094 „

'Poor's Manual' gives the average receipts per ton-mile for the trunk lines of the United States for 1900 as 0.736 cent—say three-quarters of a cent.

Those of the New York central system (10,387 miles) were		0.56 cents
Norfolk and Western (1554 miles)	... ...	0.43 „
Chesapeake and Ohio (1476 miles)	... ...	0.34 „
Canadian Pacific (8356 miles)	... ...	0.79 „

May we not suppose that as the country west of the Mississippi river is more thickly populated and developed, and local traffic increases, the trans-continental lines will gradually reduce their through-rate tariffs for all low-class freight (the only kind for which an Isthmian canal may possibly compete) to half a cent per ton-mile at most? They do that now for canned goods and beans. This is the crux of the position as to railways *vs.* canal, but only so far as the immediate fringe of the Atlantic coast is concerned. Every ton of Pacific coast goods which may be landed in New York *viâ* an Isthmian canal, and destined for inland consumption, will be handicapped as it moves westward until the total transportation charge exceeds that of the ton crossing eastwards across the continent to meet it; and the same applies to the reverse movement of trade. Two-thirds of the population of the United States are found west of the Appalachian mountain range, and the centre of population of the entire country is in Southern Illinois. It is, therefore, manifestly inadmissible to argue that inland products of the states of California, Oregon, and Washington will be shipped say 100 miles westward to a Pacific port, pay loading charges, freight by steamer, canal toll, insurance, unloading at New York, storage and agency commissions, to again move westward by railway to the interior, when such products can be transported directly and delivered, by undisturbed carload, at the point of demand, be it the smallest town found on any branch line of railway in the United States.

By the courtesy of Mr. Stubbs, Director of Trans-Continental Railway Traffic, I learn (January 2, 1902) that "the average time between San Francisco and New York for freight by rail is twelve to fourteen days; *viâ* Panamá, the schedule time is thirty days."

How far can the Pacific railways compete with a maritime canal

for the trans-Pacific trade? An examination into the recent commercial development of the Pacific coast of the Dominion of Canada and the United States brings surprise after surprise. All the important ports—San Francisco, Portland, Seattle, Port Townsend, Tacoma, and Vancouver—are preparing to share in the trade of the Orient and of all Pacific ocean countries.

Numerous lines of great steamships are entering the field for the trans-Pacific trade, and the "Pacific" railways of North America are evidently determined to control it to a large extent. The Canadian Pacific has a service to Yokohama and Hong Kong, to which they have recently added two large steamships. The "Canadian Royal Mail Steamship Line" has three steamers giving monthly service to Honolulu, Brisbane, and Sydney; the Japanese "Nippon Yusen Kaisha Company," the entrances and clearances for which at Seattle for 1900 reached over 77,000 tons net register, competes with the Canadian Pacific and Dodwell lines for the trade between Japan and the American Pacific coast, with a fine fleet of steamships; the "Great Northern Steamship Company," recently incorporated, is building three steamships, aggregating 33,000 tons capacity, to run in the Seattle-China trade in connection with the Great Northern Pacific Railway; the "Globe Transportation Company," also recently incorporated, is building steamers for the general trade of the Pacific, with headquarters at Seattle; and the "Oregon Railway and Navigation Company" is to have four new steamships for the China-Japan line from Portland, Oregon. "A feature in the shipping trade of the Pacific coast is the advent of the Glen line of steamers; from Tacoma, two steamers have already departed loaded with wheat and other freight for Europe. It intends to maintain regular sailings from Tacoma to London *viâ* Manila, Singapore, Penang, Colombo, Rangoon, the Red sea, Suez canal, Mediterranean, and continental ports. The principal cargo will be wheat for Europe, with general merchandise for the Philippines and the ports south and west of Hong Kong."* The lead of the Glen line is being followed by the "China Mutual Steam Navigation Company" to enter the same trade. Here we have a practical recognition of the great advantages possessed by the Suez canal in the matter of numerous ports along the route of vessels using it. The same consular report says, "There is no doubt the large trans-continental railways are making strenuous efforts to influence the commerce of the Orient, for the benefit of their lines, and eastern railways (not touching the Pacific shore) are continually striving for connections with this trade."

The "American-Hawaiian Steamship Company" is putting on a line of six steamers of large capacity for the San Francisco, Honolulu, and New York trade. The "Oceanic Steamship Company" has recently agreed to make eleven round trips yearly, with 3000-ton steamers,

* British Consular Report, No. 2666, on the trade of Portland, Oregon. 1901.

between San Francisco and Tahiti. The same company has three 6000-ton steamers lately arrived at San Francisco for the trade between that port and Sydney. The "Pacific Mail Steamship Company" is building two vessels of 12,000 tons capacity, each to be added to their fleet operating between San Francisco and Hong Kong, and a line to Manila is under discussion in San Francisco. Five large steamship lines are now running along the west coast from San Francisco to Valparaiso, and in this trade the "Pacific Steam Navigation Company" has recently joined the "Compañia Sud-Americana de Vapores" of Chile with four steamers each. The "Kosmos Steamship Company" (German) operates between San Francisco and Hamburg *viâ* Central and South American ports, and find the trade profitable. Most of the freight taken is landed in Peru or Chile, where the vessels secure cargoes for Europe.

What does all this great commercial preparation portend? There can be but one response, and that is that the west coast of North America recognizes and is determined to utilize its geographical position, facing the Orient, and make its ports the emporia of Oriental trade for the whole of North America, throughout which 200,000 miles of railways will receive it and give exchanges.

The railways have but little respect for the geographical position of Panamá, and seem to shatter the old idea that nature intended that man should make oceans and rivers his principal avenues of commerce; they often force the ship to abandon its old route, while they frequently ignore the largest rivers: they have turned the Mississippi into little other than a great drainage ditch. Through the kindness of the War Department at Washington (December last), I am informed that between Minneapolis (Minnesota) and the mouth of the Missouri river twenty-seven railway bridges cross the Mississippi. Fourteen of them are also provided with wagon roadways. Before railway bridges began to be multiplied across the great stream, volumes were written upon its importance as a commercial artery, and one of the arguments for the preservation of the Union, during our Civil War, was that the North could not allow the mouth of the river, destined to carry to the sea the commerce of the whole interior of the United States, to fall under control of a Southern Confederacy. How much of that commerce do the railways now allow it to carry to the sea? The great central city of Saint Louis seated on its banks will answer the question.* Total goods received in 1890, by rail, 15,375,441, and by river, 512,010 tons; total shipped by rail, 9,180,309, and by river, 245,580 tons. In 1880, the freight on wheat from Saint Louis to Liverpool *viâ* New York by rail was 42 cents per 100 lbs.; but in 1900 it was 19.30 cents, and by river, *viâ* New Orleans and sea, it was 18.41 cents. The grain

* See 'Annual Statement of the Trade and Commerce of Saint Louis for 1900.' Saint Louis, 1901.

shipments by rail to the Atlantic seaboard in 1900 were 6,786,000 bushels, as against 3,414,000 by river and sea route.

Taking commerce, engineering, cost of completion, yearly maintenance, and period of time required for construction, the Panamá canal route appears to offer advantages superior to that of Nicaragua.

This being a study in commercial geography, the military reasons which may exist for cutting an interoceanic canal do not come within my ken. They must be powerful to compensate for the long years of taxation to which the Treasury of the United States will be subjected before a canal can give any return upon the capital involved, not to mention the deficit for a term of years between revenue and cost of maintenance. The Government of the United States, and both political parties, seem, however, committed to the great venture; and, as a preliminary to its realization, have even been willing to engraft the Hay-Pauncefote Treaty upon the old Clayton-Bulwer Convention.

A powerful nation is about to make an effort, on a grand scale, to "side-track" the magnificent trade-avenues created by the private capital and resourceful energies of its own people. It will be interesting to watch the contest between an Isthmian canal and the Autocrat of the continent—the locomotive.

OCEANOGRAPHICAL RESEARCH IN THE ATLANTIC.

By HUGH ROBERT MILL, D.Sc., LL.D.

THERE has recently appeared in the *Philosophical Transactions* of the Royal Society a memoir on the circulation of the surface water of the North Atlantic, by Mr. H. N. Dickson, which constitutes an important contribution to physical geography.* It is published at an opportune moment, when our Government is considering the whole question of international co-operation in carrying out oceanographical work with a view to the improvement of fisheries, and when all the maritime nations of Europe are exerting themselves strenuously in the same direction. We propose to give a summary of Mr. Dickson's paper, necessarily incomplete, for the mass of work it contains is very great, but sufficient, we trust, to show the nature of the problem attacked, the methods employed, and the results obtained.

The introduction contains a statement of Petermann's conclusions arrived at in 1870 with regard to the part played by the Gulf Stream

* "The Circulation of the Surface Waters of the North Atlantic Ocean," by H. N. Dickson, B.SC. *Philosophical Transactions*, Series A. vol. 196 (1901), pp. 61–203.

in the circulation of the North Atlantic. This may be taken as the last word of the period of unsystematized study, which was superseded by the period of modern research with the improved oceanographical methods elaborated by the *Challenger* and similar expeditions. Petermann recognized that the current of the Gulf Stream and of the polar streams varied both in strength and direction with the seasons, and he urged that special researches on this point should be made. Between 1870 and 1890 many expeditions, equipped by different nations, and sometimes on a large scale, studied the oceanography of the North Atlantic; but they did not seriously take up the seasonal changes in the currents or in the physical conditions of the surface water. The only exception was the compilation of current-charts by the Meteorological Departments, giving the average conditions for the different months. This, however, while making the fact of seasonal change plain enough, did not make it possible to trace the actual process of change from month to month in any particular year or sequence of years.

In 1877 Prof. Ekman made a detailed study of seasonal changes in the Baltic, and he was followed by Prof. Otto Pettersson, to whose untiring efforts the high status of Scandinavian oceanographical research at the present day is largely due. Somewhat similar work was carried on round the coast of Scotland by Sir John Murray and the staff of the Scottish Marine Station. An experiment in international co-operation was made not unsuccessfully by Swedish, Norwegian, Danish, German, and British vessels in 1893 and 1894. Mr. Dickson took part in that work, and his preliminary results, published in the *Geographical Journal* for March, 1896, are familiar to our readers.

Encouraged by these results, he resolved to extend them, and at the same time to treat the subject with greater exactness than had been previously attempted for so wide an area. In order to obtain a sufficient quantity of data, it was necessary to confine the observations to the surface water only, and to adapt them to the exigencies of unscientific collectors on vessels whose ordinary route and routine could not be altered for any scientific purpose. The region selected for study was the Atlantic ocean north of 40° N., and arrangements were made with the Meteorological Office by which it was found possible to obtain a transcript of the sea-temperature observations from the meteorological logs of a large number of British ships. Additional data were obtained from some of the similar institutions in foreign countries, and a good many were sent in direct by captains who had become interested in the work. For the sake of uniformity, all temperature readings were reduced to the same scale, and the Centigrade was adopted, as the interval of 1° C. was found a convenient one at which to draw sea-surface isotherms. A number of observers took the additional trouble of collecting samples of surface water in bottles supplied in boxes of

thirty, and sent, on the return of the ship, direct to Mr. Dickson in Oxford for chemical examination.

The samples of water when received were used for the measurement of salinity by means of titration with silver nitrate to determine the amount of halogen present. The work was done with all necessary precautions, and was more than sufficiently accurate for the purpose of charting differences in salinity. We believe, however, that both Mr. Dickson and Prof. Pettersson underestimate the accuracy and the utility of the hydrometer for determining salinity by means of observations of density. Such instruments as Mr. J. Y. Buchanan's absolute hydrometer, or the total-immersion hydrometers more recently brought to perfection, yield results as good as can be demanded of any method for distributional purposes. When time permits and the expense of the method of titration is no objection, we should prefer to employ both processes, so that one set of determinations might be a check upon the other. The quantity of water placed at Mr. Dickson's disposal put the use of the Buchanan hydrometer, which is a somewhat bulky instrument, out of the question; and, as we have said, the salinities in this memoir are thoroughly accurate. For the purpose of establishing ratios, Mr. Dickson determined a number of densities by means of the laborious and difficult, though extremely exact, method of weighing pyknometer tubes filled alternately with distilled water and the sea-water under examination. The interest of the results is physical rather than oceanographical, and so need not be further referred to here. The sulphates in some samples were determined—a useful measurement, as the variation in the ratio of sulphates to chlorides is one of the best tests of difference in place of origin of sea-water.

Having described and exemplified his methods, Mr. Dickson goes on to discuss the distribution of temperature and salinity for each month of 1896 and 1897, and gives a map showing the salinity and another showing the temperature of the surface water of the North Atlantic for each month of the two years. These maps are beautifully reproduced in colour by Bartholomew, and distinctly show the seasonal variations of the conditions.

The final section of the memoir is a discussion of the movements of the surface water based upon the observations shown in the maps. It is the most interesting part of the work, and we summarize the results as stated without subjecting them to any further criticism than a general examination of the charts. These appear to bear out fully all the conclusions that Mr. Dickson has drawn from them, and they definitely prove that it is possible to keep under continuous observation the larger surface changes of the North Atlantic, as a whole, without the equipment of special expeditions, and at small expense. We earnestly hope that the Marine Department of the Meteorological Office will continue and extend these observations, which have a sufficiently

direct bearing on the meteorology and surface movements of the sea to bring them fully within its scope.

The first difficulty in the discussion is to distinguish between seasonal change in the water at a given spot, and translational change due to the intrusion of water of different origin on the surface, or of water from a greater depth raised to the surface. It would take too much space to go fully into this question here; but, allowing for all uncertainties, we may adopt with confidence the conclusions which Mr. Dickson sums up—

"The surface circulation in the North Atlantic, between the parallels of 40° and 60° N., forms, during winter, part of a cyclonic movement, resulting in a southerly and south-easterly drift on the western side, and a northerly drift on the eastern side. In the lower latitudes, about 40° N., the easterly movement is comparatively weak. The northerly movement in the eastern half of the area is considerable, but it is hampered by the configuration of the land; . . . hence the water tends to spread widely over the surface northward and north-westward, but stream currents of any marked degree of energy are not developed. Hence there is a tendency at the end of winter towards uniform distribution of salinity and temperature which is aided by a diminution in the supplies of polar water.

"In spring the north and south components become less marked, and the easterly movement becomes stronger everywhere south of lat. 50° N., the increase being most noticeable in the lower latitudes. The greater angle now made by the drift with the European coast-line causes increased 'banking up' of water against the land, and this water escapes by stream-currents running northward and southward. . . . The northward discharge of Atlantic water from the lower latitudes is therefore greater during the months of spring and summer, when a stream-current, independent of the local surface drift, sets northward between Scotland and Iceland. . . . As the summer progresses the drift circulation in the higher latitudes becomes weaker, but after midsummer the increased strength of the current from the south is replied to by an enormous delivery of polar water—first and chiefly from the area between the east and north-east of Iceland and Jan Mayen, then later, as the ice breaks up, from the polar current east of Greenland. The Labrador Current also increases largely in volume, but a greater proportion of this increase is likely to be due to melting of ice by the warm air sent up by the cyclonic circulation developed over the continent of North America. . . .

"If it be admitted that the surface circulation undergoes the periodic changes described, it appears that they follow directly from the seasonal changes in the circulation of the atmosphere at the surface, modified by the position and form of the land. . . .

"The general circulation of the North Atlantic is therefore the

result of a large number of factors, each of which is subject to wide variation. From a consideration of the mean result in its relation to the mean atmospheric circulation, it appears that the oceanic circulation is directly controlled by the winds, the form, position, and intensity of the whole of the Atlantic anticyclone, and of the cyclonic area to the north of it being taken into account. The movements of water set up directly by these systems are modified by, firstly and chiefly, the configuration of the land, and, secondly, by the effects of melting of ice."

These results indicate the great importance of ascertaining the exact relations which hold good between atmospheric and oceanic movements, a subject to the elucidation of which Mr. Dickson proposes to devote a subsequent paper. Enough has been done by him in the present memoir, and by Profs. Pettersson and Meinardus, to whom he refers, to show that the variations of atmospheric pressure, by determining the system of winds, dominate the relative strengths of the various ocean currents, which in turn directly affect the climate. The problem is ripe for further study, and promises important practical bearings.

Reference may be appropriately made, when dealing with Mr. Dickson's work, to the latest publication of Prof. Pettersson and his compatriots, although it takes for its province, not the North Atlantic only, but the whole of that ocean.* The work was carried out during 1898 and 1899, and as a result charts are given showing the distribution of salinity, temperature, and plankton in the surface water for certain months or groups of months: a word of praise must be given to the ingenious way in which the maps are arranged, although they are drawn on a somewhat intractable projection from the point of view of space required for printing. The Swedish investigators consider that temperature observations without salinities are of very little value, and they give greater weight to the distribution of plankton as a key to oceanic circulation than oceanographers in this country are likely to accept. The matter is one of those on which we have undoubtedly much to learn, and Prof. Cleve is a very competent and enthusiastic teacher. We may recall the fact that *plankton* is the general name applied to the small organisms which drift with the water. They are of many species, and some of them are not only very clearly marked and readily recognized, but are typical of certain localities in the ocean, or at least of water possessing certain physical characteristics. For example, organisms of one type are characteristic of tropical water, those of another type are characteristic of polar water, and according to the relative abundance of these two types in a given sample it is believed to be possible to estimate the relative proportion of tropical and

* 'Les Variations annuelles de l'eau de surface de l'Océan Atlantique.' Par P. T. Cleve, G. Ekman, O. Pettersson. Göteborg. 1901.

polar water in the mixture. This is a very simple case, but by recognizing types characteristic of minor differences in origin, and accepting the theory that where these organisms are found they must have been carried by the water in which they float, systems of quite elaborate circulation may be deduced from the contents of a series of tow-nets. In fact, the minute crustaceans and protozoans of the sea are looked upon from this point of view as mere multitudes of drift-floats, each species marked with its own place of origin. This method of research appeals to the imagination, and when biologists have definitely ascertained the physical conditions of which each type is characteristic, the oceanographer will have gained an instrument of research of vast importance. The happy combination of biological, physical, and chemical knowledge in the Swedish triumvirate who sign this memoir has certainly proved that the new method is one of important possibilities.

The result of the study of variations in salinity and plankton for the period considered is the recognition of three elements concerned in producing the surface circulation of the Atlantic. These are given as—

(1) A flow of Atlantic water towards the northern hemisphere in spring along the eastern shores of the ocean, actuated by a force which seems to originate in the antarctic seas.

(2) An extension of the Gulf Stream towards the European seas in autumn.

(3) A flow of arctic water from the neighbourhood of Greenland and America towards Europe in winter, as a consequence of the melting of the ice in the polar current, which affects the opposite shores in that season.

One thing that is established by these researches is the unity of the ocean, and the consequent necessity of investigating all parts of it simultaneously and systematically, were it only in order to direct intelligently the fisheries off our own coasts.

Occasional and spasmodic efforts have been tried and found wanting. The work that is now required is of the thorough and persevering type pursued by Mr. Dickson and the Scandinavian investigators, but with the ampler means and assured continuity that Government funds and international co-operation can alone command, and with observations made, not at the surface only, but at all depths in the water. If special vessels devoted to scientific work were provided for the North Sea and the margin of the Atlantic, their results, combined with surface observations over the breadth of the ocean, would tell us all that it is necessary to know in order to complete our knowledge of the circulation of the seas affecting Europe.

REVIEWS.

ASIA.

The Geography of the Græco-Persian Wars.*

Mr. Grundy is one of those historians who consider that the serious treatment of the physical phenomena of a country is a necessary and important element in history. After nearly a year spent in learning the principles and practice of surveying, he visited Greece in 1892–93, as the Oxford Travelling Student of the Royal Geographical Society, surveyed Platæa and Leuctra, and examined the western passes of the Kithæron range, and the roads leading to them from Attica. In 1895, and again in 1899, he was enabled, by grants from Brazenose College, to revisit Greece, and on these occasions he was able to complete his examination of the roads and passes utilized by the Greek and Persian troops; to examine the field of Marathon, the Euripus, and the Strait of Salamis; and to make detailed surveys of Pylos, Sphakteria, and the pass of Thermopylæ. The surveys were carried out within the limits of Oxford vacations, and consequently at high pressure, either in winter, when snow and mud make movement from point to point difficult and sometimes impossible, or in summer under a burning sun, when malaria is rampant, and even deadly, at such places as Pylos and Thermopylæ. Mr. Grundy was fortunate in escaping with an attack of ophthalmia, which is as prevalent at Thermopylæ to-day as it appears to have been in the days when Leonidas held the pass.

Mr. Grundy shows a good grasp of the geographical and topographical features of the theatre of war, and a just appreciation of their military importance. The great influence of sea-power, first in the hands of the Persians, and then of the Greeks, upon the course of events is well brought out; and attention is frequently drawn to the important part which physical features played in the general conduct of the war, and in the actual conflicts on the field of battle. The author is, I believe, the only recent historian of the "Great War" who has taken the pains to prepare himself for his work by a systematic study of the country in which it was fought, and who has written with such full knowledge of the localities made memorable by the victories and heroism of the Greeks. The results are some excellent maps and plans, and a series of geographical and topographical discussions which, resting as they do on personal knowledge, are of great value. They confirm the general accuracy of Herodotus when he describes the topographical features of places which he actually visited, and throw light on many details of the military operations which were previously obscure.

It is difficult to select any portion of the geographical work for special comment, but attention may be drawn to the descriptions of the passes in the Kithæron-Parnes range, of the battlefields of Marathon, Thermopylæ, including the detailed account of the "Path of the Anopæa," and Platæa, and of the physical features which had such an important influence on the conduct of the naval operations in the Euripus and the Strait of Salamis. The discussions are illustrated by well-selected photographs, and copies of several of Mr. Edward Lear's watercolour sketches of Greece. The papers on Platæa and Leuctra by Mr. Grundy, published in 'R.G.S. Extra Volumes,' 1894, were full of promise, and the present volume is an ample justification, if any were needed, of the policy adopted by the Society, of encouraging the scientific study of geography at the Universities.

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* 'The Great Persian War and its Preliminaries.' By G. B. Grundy, M.A. John Murray. London, 1901.

The above notice has been confined to the geographical and topographical information, as to the value of which there can be no doubt. The whole work bears evidence of great labour and research; but it would have been more acceptable to the general reader if it had been less drawn out, or if its contents had been differently arranged. The continuity of the ever-fascinating story of the "Great War" is frequently broken by discussions of motives and possibilities, which, interesting as they are, must be necessarily inconclusive, and might have been relegated with advantage to Appendices or Supplementary Notes. In some instances the discussions have led to repetition, and in others they appear to be of unnecessary length. Many of the conclusions will meet with general acceptance; and the only regret is that, in discussing questions of this class in the body of the book, Mr. Grundy has to some extent obscured the grandeur of the story. The criticisms on "the war as a whole," and on "Herodotus as the historian of the Great War," in the last two chapters are much to the point, and will repay careful perusal. Mr. Grundy's work is one of unquestionable value, and it is satisfactory to know that he proposes to deal with the period after 470 B.C. in a separate volume.

C. W. W.

AFRICA.

The Ophir Question.*

In attempting to solve once for all this much-debated question, Prof. Keane does not bring forward many new facts or decidedly novel theories, but his task has been rather to take up the threads of the controversy and weave them into such a connected whole as may present a solution convincing from the harmony of its several parts. In the problem as a whole there are two main questions, which have often been treated as one, but which the author shows with much force to be quite possibly distinct—that of the original source of the gold of Ophir, and that of the locality of Ophir itself.

We must be content here to state the general conclusions arrived at by Prof. Keane, referring our readers to the book itself for the detailed argument. The gold-producing country he holds to have been without doubt Rhodesia, pointing out both the vast extent of the old mining operations and the existence in the country of most of the products associated with the gold of Ophir in the Bible story. A strong point in favour of this view (the correctness of which has become more and more probable with every fresh antiquarian discovery) is the consideration that, owing to the absence of commodities to give in exchange for the gold, the merchants must have been forced to employ slave labour to procure it, which would have hardly been possible in a populous and politically organized country such as India. Rhodesia, however, was not Ophir, which is shown with much reason to have been, not the producing country, but the great emporium whence the gold and other commodities were distributed. This (after rejecting all other theories) Prof. Keane finds, with Ritter, in Southern Arabia, where all the elements necessary for successful identification are present. Here, in the district of Dhofar, explored by Bent during his last journey, is still an ancient Himyaritic population, agreeing with the statements in Genesis, which connect Ophir with the Joktanides. Here, as shown by Ritter, was "Sephar, a mount of the East," by which the habitat of Joktan's sons was limited. Here, too, was the port of Moscha (the Mesha of Genesis), still neighboured by ancient ruins—the Portus Nobilis of

* 'The Gold of Ophir, Whence brought, and by Whom?' By Prof. A. H. Keane. London: Stanford. 1901.

Arrian, known to have been once a great emporium. And lastly, here, in the Sapphara of Pliny and Ptolemy, shown by Glaser to represent Ṫafar (Saphar or Aphar), we have the actual name Ophir, which is to be translated "metropolis," the city of cities, just as its port was the port *par excellence* of the Eastern trade. Hither were brought the mineral riches of South Africa, the peacocks of India and Ceylon, the spices of the surrounding regions, to be eventually laden on the navies of Solomon and Hiram.

In these main conclusions we imagine that Prof. Keane will carry with him the majority of his readers, but in some points of detail he is on less firm ground. Thus the gold land of Havilah he identifies as Rhodesia, and Tharshish as its port (Sofala or Beira ?), mainly from the difficulty of finding elsewhere an adequate source of gold-supply, and the association of the names Havilah and Ophir in Genesis, as if both concerned in the same trade. Certain questions suggest themselves in this connection. Why, it may be asked, should Solomon's ships have made the long voyage to Tharshish if gold was to be had at Ophir? Why does the name Havilah not occur in connection with this trade? How is the association of Havilah with Sheba—certainly in Arabia—to be explained? If Tharshish is merely the port of Havilah (a country without political organization), should we expect to hear of "the *Kings* of Tharshish and the Isles"? Did Solomon and Hiram, or only the Himyarites, employ the slave-labour at the mines? and if the latter, how were they paid by the former? Why do we hear of peacocks as brought by the ships of Tharshish, not by ships of Ophir?

Some at least of these difficulties would be obviated by the simple supposition that Tharshish = Moscha, and was thus itself the port of Ophir, the two names being used generically by Phœnicians and Himyarites respectively as the designation of a great emporium of trade, so that the one would be virtually a translation of the other. A Tharshish in Arabia would suit well with the passage in Psalm lxxii., the second half of the verse being in this case, in accordance with the genius of Hebrew poetry, a sort of echo of the first; and also with the passages of Ezekiel, in which Tharshish, as Ophir elsewhere, is referred to in terms implying it to be a great commercial centre, rather than an outlying port.

The latter part of the book sketches the history and enterprises of the Himyarites, especially in Rhodesia. Into this we need not enter, as the subject is partly covered by Messrs. Hall and Neal's recent work, of which it is proposed shortly to give an independent notice. E. H.

POLAR.

Dr. von Neumayer and Antarctic Research.

Prof. Georg von Neumayer has collected into a substantial volume* the numerous contributions which he has made from time to time during the last fifty years to the cause of antarctic exploration. His insistent advocacy of every branch of scientific investigation at sea, and especially towards the poles, is too well known, and has been too highly appreciated in this country, to make it necessary at this period to give a critical summary of the contents of the book before us. Dr. von Neumayer has pursued his aim unfalteringly for half a century, and the generous manner in which he brought the weight of his great influence to bear on the promotion of the British Antarctic Expedition in its early stages will

* 'Auf zum Südpol! 45 Jahre Wirkung zur Förderung der Erforschung der Südpolar-Region, 1855–1900.' Von Prof. Georg von Neumayer. Berlin; Vita Deutsches Verlagshaus. 1901.

not easily be forgotten. If the name of a cherished locality is ever engraved by the earnest thought of years upon a human heart, Dr. von Neumayer's is marked broad with the word *Südpol*. It is useful to have in a collected form these various papers of different date, but the volume has a warmer interest for geographers than even the centre of the frigid zone can kindle. It reveals something of the personal history of an honoured friend and master, an unexpected side-light of autobiography, reflecting the glow of an ardent and adventurous youth on the placidity of a singularly gracious age. The beauty of the photograph of the Director of the Deutsche Seewarte as he is to-day—though the picture has an air of sternness foreign to our memory of the man—will convince even a stranger that the artist's pencil did not flatter the young sailor of half a century ago. These two portraits of themselves make the book worth possessing.

Piecing together the hints in the preface, the introductions to the different memoirs, and the episodes alluded to in abstracts of the earlier lectures, we can trace the origin and growth of Dr. von Neumayer's passion for the south pole; and the task leaves us full of regret that the autobiographical framework is so narrow. Still, what there is of it is welcome, for it shows us a German, enthusiastic in his patriotism beyond the majority of his countrymen, yet unswerving in his loyalty to the great republic of science where all nations are as one.

On taking his degree in 1849, Georg Neumayer's mind was full of the exploring voyages of Ross, Wilkes, and Dumont D'Urville, and the scientific deductions of Gauss and Sabine. Resolved to pursue his studies in terrestrial magnetism and in the science of the ocean, and not without the ambition of aiding a united Germany to arise and grow into a maritime power, he made a voyage to the east coast of South America in a Hamburg ship in order to acquire a practical knowledge of nautical astronomy and navigation. On his return he passed his examination as mate, and spent several months in the effort to obtain a post in the Austrian navy, Austria being then the most powerful maritime state of the German Confederation. Failing in this, he gave a series of lectures in Hamburg on Maury's theories of the ocean and on the recent improvements in the science of navigation; and since he could find no other way of gratifying his craving to see the southern hemisphere, he shipped as a common sailor and landed at Port Jackson in Australia in 1852. Two years were spent in the Australian colonies, part of the time as golddigger at Bendigo, and, when the digging was unfortunate, as a lecturer on navigation in a tent on the goldfields, where an audience of disappointed sailors could easily be brought together. In 1854 he returned to Europe on a sailing ship with a mutinous crew, and he came back resolved to leave no stone unturned to get up a voyage of scientific exploration towards the south pole, or a journey into the then unknown interior of Australia.

He was fortunate in making the acquaintance of Alexander von Humboldt, Dove the meteorologist, and the great chemist Liebig. King Maximilian II. of Bavaria, an enlightened patron of science, who consulted Liebig as his chief scientific counsellor, considered a memorial drawn up by Neumayer on the important results bearing on antarctic research which would accrue from the study of terrestrial magnetism at Melbourne, and granted the funds for establishing the well-known Flagstaff Observatory. In August, 1856, before leaving for Melbourne, Neumayer laid his plans for a physical observatory before the British Association at Cheltenham, and received the approval of Whewell, Airy, and Faraday.

While carrying on the magnetic and meteorological observations at the Flagstaff Observatory, and collecting on Maury's plan all possible data as to the navigation of the Southern Ocean, Dr. Neumayer took a prominent part on the committee which directed the exploration of the interior of Australia; but in 1862

he once more returned to his favourite subject of antarctic exploration. In a farewell address to his countrymen at Melbourne as he was leaving for Europe, he said—

"It would be a glorious moment in the next period of my career if I could seek the antarctic regions in a German ship, and perhaps sometime you will see me return to these shores accompanied by the pick of the youth of all German races, bound on a voyage to the south pole."

So far did the coming of the *Gauss* cast its shadow before; though none of the young Germans now in the antarctic ice were born at that time, nor was the united German Empire, which made such a national enterprise possible, then in sight.

Dr. Neumayer always urged the practical side of antarctic research; he showed how it would increase the certainty of navigation, and how it would stimulate the spirit of maritime enterprise which, from his student days, he had recognized as an indispensable element of national greatness. Thus he took as the theme of his first serious appeal on returning to his fatherland, at Frankfort in 1865, the importance of antarctic exploration and the necessity for the foundation of a central institution for the systematic study of oceanography and marine meteorology. The latter suggestion was acted on in a liberal spirit, and in his direction of the Deutsche Seewarte at Hamburg, Dr. von Neumayer has fulfilled his life-work and placed his country in possession of an oceanographical institution of which Maury himself would have been proud, and which is the admiration, if not the envy, of the oceanographers of other countries. Not only has it proved of inestimable practical value to the seafarer, but it has afforded training to a number of scientific men whose names, already well known, are destined to occupy a high place amongst the students of nature.

How nearly the other design was accomplished also has probably been forgotten by most of our readers. Dr. Neumayer suggested that an expedition for antarctic research should be fitted out as a preliminary to the Transit of Venus expedition in 1874. The Vienna Academy of Sciences took the matter up cordially on the advice of Admiral Tegetthoff, and Dr. Neumayer was promised the command of an expedition to set out from Hamburg towards the end of 1870. The outbreak of the Franco-Prussian war and the birth of the German Empire interrupted the expedition; but Admiral Tegetthoff revived it in the following year, and all was going well when the sudden death of the admiral brought the plan to an untimely end; so Austria-Hungary lost the honour of renewing south polar research, and Dr. Neumayer the opportunity for becoming an explorer.

We need not enumerate Dr. von Neumayer's further efforts to revive interest in the subject in his own country and amongst the geographers of the world. He strove at the meetings of the International Geographical Congresses (especially at London in 1895), at successive gatherings of the German "Geographentag," at other assemblies of men of science in many countries; and at last he saw the naval flag of his country flying over an expedition commanded by a man of science, while his sympathies were scarcely less heartily extended to the British National Expedition, which started almost simultaneously with a plan of complete international co-operation in the cause of science. Dr. von Neumayer acknowledges that he has not been able to give effect to all his wishes with regard to antarctic exploration, and he states, with an emphasis for which we should have thought there ought to be no necessity, that his efforts have always been solely for the advancement of science and the good of his country. H. R. M.

OCEANOGRAPHY.

Miss Giberne on the 'Mighty Deep.'*

This book "attempts to cull a certain number of leading facts from the great storehouse of knowledge, and to put them in order, for the many who love sea-breezes and ocean waves, and who may like to know a little more about the friend whom they so often visit." The author has consulted a considerable number of books and papers on oceanography, and gives, on the whole, a fairly accurate account of some of the results of recent research, although without the first-hand critical knowledge essential in selecting for a book of the kind. The chief defect of the book is that it attempts to explain too much, and describes too little, and this is accentuated by the facts that there are only nine illustrations and no diagrams.

GENERAL.

Sergi on the Mediterranean Race.†

Prof. Sergi's 'Stirpe Mediterranea' appeared in 1895, and was revised for a German translation two years later. Now appears in English a more thorough revision, taking account of recent criticism up to about the beginning of 1900. This limit may be deduced from the final chapter, evidently printed off before Mr. A. J. Evans's great discovery of Cretan tablets had become known. Among recent English works bearing on his subject, Prof. Sergi takes especial account of Keane's 'Man Past and Present' and Ripley's 'Races of Europe;' and also of the archæological results arrived at by Messrs. Evans, Petrie, and Ohnefalsch-Richter, in Crete, Egypt, and Cyprus respectively.

After five years Prof. Sergi does not see reason to modify any of his main craniological conclusions. And, indeed, his demonstration of the existence of a pre-Aryan population and civilization in the Neolithic Age over much of North Africa, all South and West Europe, and part of Western Asia has been very generally accepted, at least as a working hypothesis. The absolute identity of that race everywhere and of the civilization over so wide an area has raised more doubt, but, broadly stated, seems to prove not less acceptable. The original derivation of this "Eurafrican" stock from the African Lake Land, however, remains no more than a suggestion. Prof. Sergi adds no fresh documentary evidence to the very little he adduced in 1895. For general credence to be given to his theory concerning the character of the Aryan invaders of Europe he has still to wait. Apart from all pro-Aryan prejudice, it is hard to believe that the "Eurasiatic" peoples, whose linguistic system contained such potentiality that (as the author admits) it overwhelmed the Eurafrican system wherever issue was joined, were utter barbarians, who had to learn all their culture from the non-Aryan population.

The author's primary documents are, of course, skulls. These he treats as a master, but on a system not universally accepted by craniologists. In view of the great fluidity of this kind of scientific investigation, an impartial handbook on methods of craniology is urgently needed at the present juncture; and this should be written by a first-rate anatomist or pathologist, qualified to show from his own

* 'The Mighty Deep and what we know of it.' By Agnes Giberne. C. Arthur Pearson, Ltd. 1902.

† "The Mediterranean Race: a Study of the Origin of European Peoples." By G. Sergi. Pp. xii., 320. 93 Illustrations. (Contemporary Science Series.) London: Walter Scott. 1901.

point of view why certain modifications in skull-form should be persistent, how far they really indicate race, what they imply as to racial character, and how far the conditions under which they occur exclude other forms. We confess to certain doubts of the empirical methods and the deductions of all craniologists based on their kaleidoscopic disagreements and their selectiveness. Exceptions to their classifications seem too often to be put on one side as "pathological;" and they do not satisfy us that skull modification always implies variety of race. For instance, the modern Greeks of Asia Minor (where there has been no Slav or Albanian inroad) are now at the top of the short-skulled class; the ancient Greeks in the same region were, apparently, near the bottom of the long-skulled. Has there been any change of race, or can this skull-modification come about independently of such change? Or does length of skull matter at all?

Prof. Sergi uses archæological evidence as secondary, but gives it great prominence. His views on the racial basis of primitive Mediterranean civilization were "in the air" before he wrote; and few archæologists now question the pre-Aryan character of early culture in a part, at any rate, of the area, pending the decipherment of the Knossian tablets, and the definite ascription of Etruscan, Lycian, and Hittite to a family of tongues. Archæology, however, is not the author's subject at first hand, and his acquaintance with its evidence is not comprehensive enough for him to pronounce on such questions as the original seat of Mycenæan civilization. He does not seem to know the "pre-Mycenæan" Ægean, and the all-important ceramic evidence gained there. His confident ascription of the Lemnian inscription to Pelasgo-Tyrrhenians would be more valuable if he showed knowledge of other uninterpreted inscriptions in the Ægean, *e.g.* the Præsian stone, or the Lycian texts, and of the difficulties in regard to the application of the name Pelasgi to any very definite or comprehensive race. We doubt if he is up to date about the "Hittites" and the distribution of "Hittite" monuments; and he proves so much from tomb-forms and burial methods, that nearly all the population of both hemispheres might be Eurafrican.

D. G. H.

Guide-Books.*

Messrs. Macmillan, who have exceptional opportunities for gauging the needs of cultivated tourists from both sides of the Atlantic, have recognized that new guide-books, and not merely revised editions of old ones, written originally when all conditions of travel and taste were vastly different from now, must be provided; and that, moreover, in a cheaper and more portable form for the English-speaking world, which is not wholly satisfied with anglicized versions of guides, first written, however admirably, by and for persons whose habits and tastes are not its own.

In different ways all the four guides quoted above go far to satisfy this demand. No. 1 covers the ground of Murray's 'Mediterranean,' ii.; No. 2 comprehends, at the same price, the scope of Murray's 'Mediterranean,' i., and also his 'Constantinople, Brusa, and the Troad;' No. 3 puts Egypt and Palestine into one very handy volume of about 250 pages at no greater cost; and No. 4, at one shilling more, includes all Italy, but runs to nearly 500 pages. In applauding the aims of Messrs. Macmillan, we would urge them to realize this even more fully in subsequent editions, and to consider seriously whether certain kinds of information remain in sufficient demand among guide-book users to justify the further retention of certain sections. For instance, in Italy, or in any country where the railway

* Macmillan's Guides: (1) Western Mediterranean; (2) Eastern Mediterranean; (3) Palestine and Egypt; (4) Italy. London: Macmillan & Co. 1901.

system is highly developed, is there any use in devoting a section to "Routes"? The railway guides and the railway maps nowadays suffice to determine the destination, and the locomotive does the rest. Trains go too fast for a mere brief description of the views right and left from the track to be in much request. Such a section in an Italian guide seems to us, in fact, to be a needless survival of the old posting days, and by its excision in this case the book would be lightened by forty-seven pages. We hope, further, that the publishers will put a narrow limit to advertisement matter, or that may become as serious an incubus to the public as in the *Continental Bradshaw*.

Again, does the kind of tourist who would read with any profit Mr. Fry's admirable, but very general, notes on Italian art prefixed to this guide, naturally look to a guide-book for such information at all? Our experience is that he does not. Art handbooks are now legion, as are also school histories. In the editor's place we should consider very seriously if historical and artistic introductions are worth more than the saving in bulk and cost involved in the excision of over seventy pages. The same consideration might be extended to the Egypt guide, though the saving in that case would be far less. The plan of departing from geographical order in the case of Italian places of interest, and arranging them as in a dictionary, is excellent; and the notes therein seem as admirably concise as the hotel information is up to date and the maps are clear. In the latter connection we would offer one hint. Railways are the one thing needful to modern tourists, and their lines should blaze out on all tourist maps. On many of Messrs. Macmillan's maps they do shine in vermilion, but on many they do not, *e.g.* on the map prefixed to the 'Eastern Mediterranean,' which errs further in including a great deal to which the text has no reference, and thereby obscuring what is really essential for the tourist.

We note with much approval that a considerable change has been made in the method of dealing with sights and places of interest. The notices no longer read like the recollections of an intelligent traveller returned and describing what he had seen, but are definite directions to a new-comer arrived on an unfamiliar spot. Such a one wants to know what lies to right, left, and before; where he will get to if he takes a certain path; how to reach places, and how to understand what he sees therein. There is still room for improvement, more especially where no good previous guide has formed a basis, *e.g.* in the cases of Crete and Cyprus. In these two great islands, both, for different reasons, singularly interesting to Englishmen, the new guide shows not only no improvement on, but marked inferiority to, the guide-books written a dozen years or more ago. Almost no indication is supplied of their points of interest, and none of how these points are to be reached.

Conciseness cannot be carried too far in guide-books. It must be pushed even to a sort of Tachygraphy of style, and signs and symbols should be freely used to save repetitions and space. Whether the Baedeker asterisk should or should not be adopted, opinions will always differ. We do not advocate the introduction of the unadulterated "drill-book" system of guide writing, or of wholesale "personal conducting," but confess that we have often found discriminating marks very welcome in large galleries and on extensive sites. Few, we fancy, would complain of Mr. Fry's asterisks, if Messrs. Macmillan confided the Italian selection to him, and the great majority of tourists would certainly breathe sighs of relief on submitting to his guidance. The very few who have genuine views of their own will always supplement their guide-book with other manuals, and therefore they need hardly be considered in this matter.

If Messrs. Macmillan push their own ideas of method to their logical conclusion, and take a leaf out of Baedeker's book in such matters as rewriting at short

intervals, sending special emissaries to observe and describe, according to a rigid scheme, and under the direction of a rigid editor-in-chief, we have little fear for the success of their new venture either in Great Britain or in America.

D. G. H.

Education.*

As Mr. Redway remarks in his preface, "this book is intended to set forth in an elementary manner the relations between human activities and geographic environment," and in spite of a good deal that has been written during recent years to illustrate the intimate nature of these relations, he has, unfortunately, only too good reasons for supposing that this method of regarding geography is new to many teachers of the subject.

In the opening chapters an interesting outline is given of the historical development of geographical ideas. Though several countries around the Eastern Mediterranean were early civilized, Greece may be regarded as the birthplace of geography, for it was here that geographical knowledge was first systematically formulated by Herodotus and other writers. Mr. Redway attributes the rapid development of Greek power and ideals partly to the configuration of the country, and partly to the influence of events resulting from the siege of Troy. In fact, throughout this historical sketch his main object is not only to show how powerfully geographical forces have controlled the life of various peoples, but the important events that have therefore resulted from any disturbance of the physical environment. Probably the best example of the effects of such a disturbance is seen in the wonderful discoveries that resulted from the Turkish blockade of the trade communication between Europe and the East just at the moment when, on account of the reports of Marco Polo and other travellers, Europe had formed exaggerated ideas of the wealth of those parts. Thwarted in one direction, men turned to seek new routes to the Indies, and this search led Vasco da Gama round the Cape of Good Hope to India, caused Columbus to be the accidental discoverer of new lands in the West, started Magellan on the famous voyage that ended in the first circumnavigation of the world, and stimulated men to penetrate even the frozen Arctic regions in hopes of finding north-west and north-east passages to their goal; in fact, in Mr. Redway's opinion, it gave us a New World and regenerated the Old.

In the third chapter some account is given of the evolution of land-forms, stress being laid on the modern view of the changing nature of physical phenomena, as opposed to the old idea of their fixity. This is followed by a description of the effects of climate and topography on the distribution of life and on commercial development, with special reference to the economic history of the United States, while the latter part of the book is devoted to discussion on methods of teaching geography and the use of apparatus. Several useful suggestions are given with reference to observational and field work, which are rightly regarded as forming an essential part of geographical education, and the special preparation of the teacher demanded by the new conception of geography is well set forth.

Though the book may be too sketchy to aid students specializing in any particular branch of geography, it is certainly one that should be welcomed by teachers of the subject as at once stimulating, suggestive, and of general practical utility.

J. B. R.

* 'The New Basis of Geography.' A Manual for the Preparation of the Teacher. By J. W. Redway. Published by the Macmillan Co. 1901.

THE MONTHLY RECORD.

EUROPE.

The Survey of British Lakes.—Sir John Murray has nearly completed his arrangements for beginning the work of investigating the lakes of Great Britain and Ireland, which he has undertaken in conjunction with Mr. Laurence Pullar. He intends to begin with the lochs of Perthshire, some of which he had already surveyed with the assistance of the late Mr. Fred. Pullar. Sir John Murray will take up his residence for a time in the Loch Rannoch region. Sir Robert Menzies has very kindly placed Rannoch Lodge at Sir John's service, and in other ways has shown himself desirous of doing all he can to give facilities for the work. Let us hope that other proprietors will follow Sir Robert Menzies' excellent example.

The Lower Pechora.—In the year 1901, M. A. N. Novosiltsof was sent to the Pechora with the party of Captain Sergieyef to execute surveys and take meteorological observations. From Archangel he travelled to Ust-Tsylma, at the confluence of the rivers Pizhma and Tsylma with the Pechora. This town is the centre of the Pechora district, covering an area of 109,390 square miles, and containing a population of 33,371. About 6000 persons live in the town itself by boat-building, fishing, to a small extent by agriculture and reindeer-grazing, and to a much larger extent by carrying goods and trading. After receiving the Pizhma and Tsylma, the Pechora has a breadth of fully $1\frac{1}{4}$ mile. North of Ust-Tsylma the population is settled on the river-bank, and eastwards there are no settlements as far as the Ob, more than 450 miles distant. Both banks are clothed with coniferous woods, rarely interrupted by foliage trees. Building timber is found in general only up to the parallel of 67°. Five miles above Pustozersk the Pechora divides into a multitude of channels, most of them fairly deep, but containing shallows useful as fords, but serious obstacles to navigation. Beside the river are many swamps and lakes, some of which run parallel to the bed for several miles without any connection with it. Chief of these is the large Pustoye Ozero, on the western side of which stands the village of Pustozersk upon a sandy mound. It contains about 180 persons, who make a comfortable living by fishing and trading with the Samoyeds. Across the lake is the village Ustye, very similar in appearance, and 25 miles to the south Velikovisochnoye, which trades with the Malozemelskaya tundra and Kolguyef, as Pustozersk and the villages north of it do with the Bolshezemelskaya tundra. Some of the Pustozersk traders go even as far as Obdorsk. In winter the mouth of the Pechora is completely deserted, while in summer people come down on barges from Cherdyn, in the Perm government, bringing corn and other goods to exchange for fish and the products of the chase. Just at the mouth of the river in the Bay of Pechora is the Bolvanskaya bay, on the east side. The shores are high near the Bolvanski cape, and in the middle of the bay a number of hills stand near the shore. Huts are erected here for the white grampus fishery. North of the bay are situated a row of sandy islands called the Guliayevy Koshky, which are placed on maps a mile too far towards the west, and 9 miles too far north. Gwyniad is caught here in summer and sold to Cherdyn traders. The work of surveying was commenced in the beginning of May at the Konstantinovski cape, where it was found that there was no tide, the ice, 4 to 7 feet in thickness, lying perfectly quiet. The ice in the bay broke up on May 28, and was piled up by the tide along the shore. On June 24 and 25 the rise of the tide was $2\frac{3}{4}$ feet, but on the 28th no tide was perceptible. The shores of the bay are rising and constantly contracting the water area. Near Cape Cherni Lopatka three strand-lines may be seen—a high bank 5 miles from the water; a second a few yards in height, receding sometimes

as much as a mile from the water; and the present shore, exposed for a long distance at low tide. Quantities of wood are cast ashore, and, especially at high tides, are carried far inland. A dozen miles below Konstantinovski cape a small range, the Pitkof Kamen, runs parallel to the coast and rises to a maximum height of 595 feet. In spring the Samoyeds, coming northwards after winter, visit the slopes of the Pitkof to save their reindeer from the horse-flies and gnats. By the Pogancheska bay also, and beyond, opposite Varandei island, runs a range, the Enei, a summer residence of Samoyeds, people of Pustozersk and others, engaged in reindeer-breeding. They also hunt seals and birds, especially in spring, when the nights are light and the weather not too cold.—*Izviestiya* of the Russ. Geogr. Soc., No. 2, 1901.

ASIA.

Austrian Expedition to Southern Arabia.—We learn from the *Deutsche Rundschau für Geographie* that an expedition to Southern Arabia for purposes of scientific research has been undertaken by Dr. Hein, of the Vienna Natural History Museum, who is accompanied by his wife. Mahalla will be the first place to be visited, and attention will be paid both to ethnological and linguistic research and to natural history collections.

Ignatov's Exploration of Lake Telezkoie, Altai.—A short account of the results of Ignatov's expedition to Lake Telezkoie, or Altyn Kol, in the Altai despatched early last summer by the Imperial Russian Geographical Society (*Journal*, vol. xviii. p. 212), appears in No. 2 of *Globus* for the present year. The lake (of a visit to which a graphic description was given by Atkinson in his 'Oriental and Western Siberia') lies in a narrow valley at an elevation of 520 metres (1700 feet) above the sea, and has a length of 48 miles, with a breadth varying from 350 yards to 3½ miles, the widest part being in the south. The main portion of the lake runs north and south, the Chulishman river entering at the southern end, while the Biya, which makes its exit at the north-west, joins the Katun to form the upper Ob. The mountains rise precipitously on all sides, clothed with cedars, silver firs, larches, etc., and the rocks consist of much tilted clay-slates and limestones, with some granite and conglomerate. Tectonic causes have evidently contributed to the origin of the lake. The result of 2500 soundings is to show that it is shallow in its northern east-to-west section, but reaches a depth of over 1000 feet in the south. There are two deep basins, separated by a submarine ridge, over which, however, the depth is still as much as 870 feet. In a remote future the lake may be cut up into several separate parts by the encroaching deltas of streams. In the middle of June, the temperature of the water remains at 39° Fahr. at the surface, and 37½° in its lower layers, while that of the inflowing streams is already from 48° to 57°. About the middle of July, however, the surface temperature rises to from 53½° to 61°. The shallow portion freezes over in November; the deep southern part is rarely frozen—perhaps once in seven years. The water is very transparent, a white disk being visible at depths of 30 to 46 feet, as compared with one of 20 feet in the Lake of Geneva in summer.

AFRICA.

Lake Busumchwi, Ashanti.—Mr. Malcolm Fergusson, the surveyor who accompanied Mr. J. E. Moore on his expedition to the Central African lakes, sends us an account of Lake Busumchwi, Busumkwi, or Busunetki, as the name is variously rendered by the dwellers in its neighbourhood, together with an outline-map based on his survey, of which a reduction is given herewith. The lake, which lies about 25 miles south-east of Kumasi, is the sacred lake of the Ashantis, the

LAKE BUSUMCHWI
[ASHANTI]
FROM A SURVEY BY
MALCOLM FERCUSSON, A.R.S.M.
1901.
Scale of Miles
1 0 1 2
Nat. Scale 1:100,000 or 1·578 miles = 1 inch.
TRUE NORTH
Alt. 300 feet
Abonu
Wabu
Enkwawi
Sisilwa
Pippe
Ejatu
Aborajum
Abasi
Egnotiassi
Bodukwanu
Konkoma
Kwesi Bipossu H.
Bipossu
Diforchiassi
R. Bonni
R. Peswa
Ejamum
Isasi
Anamraku
Dotiassu
Amakum
Ataframa
Ankassi
Obimba
Bippo Hinkwa
Aduamoshiwa
R. Chadi
Isasi
Bansu
Apiu
Dompa
Chumbwa
Chuo
Obuassi
1850
Kobinatanokrum
Takrum
Besiassi
Road to Bekwai
Ampeha
Ampento
Ahuri
Kusiassi
Embrantwa
R. Ahiawa
Ahantasi
Warassi
R. Bokwabo
R. Bakutsi
Drunssi
Road to Kumasi
R. Komoe
ASHANTI
TOGO
Abomey
LAND
Kumassi
L. BUSUMCHWI
IVORY COAST
GOLD COAST
Togo
Aodwa
Elmina
Accra
Cape Coast Castle
Gr. Bassam
Scale of Miles
Nat. Scale 12,500,000
50 100 200

word "busum" meaning sacred or fetish. It is nearly circular, with a maximum diameter of about 6 miles, and has been on this account erroneously described as a crater-lake, the geological formation—chiefly talcose and quartz schists with intrusive bosses of granite—showing no signs of volcanic action. It lies in a large basin entirely enclosed by hills with an average altitude of 800 feet, that of the lake itself being but 300. The hills are clothed with forest which descends to the shore in places, but has been mostly cleared for plantations near the water. Owing to its sacred character, boats have not hitherto been allowed on the lake, and its depth has not been ascertained, but all appearances point to one nowhere exceeding 20 feet, the shores having a very gradual slope. There are several inflowing streams discharging the drainage of the surrounding hills, which exceeds the amount lost by evaporation, so that the level is just now rapidly rising, as is evidenced by the trees standing in the water, those at a distance from the shore being now dead. Since February, 1900, a rise of 18 inches seems to have taken place. No breeze reaches the lake, and the temperature of the air is stifling, occasionally proving unbearable even to the natives. The water is slightly brackish and extremely fishy in taste, and as the natives, who are much subject to leprosy and other skin diseases, make use of it extensively for bathing and washing clothes, it is hardly safe even to wash in the water unless boiled. The lake teems with fish, which are, however, not easily caught with a baited hook. The natives, whose great industry is fishing, catch the fish by means of huge wickerwork baskets open at the ends, which are woven from the split stems of a kind of lily. When fishing, they paddle themselves about with their hands, seated on dried logs of the cottonwood tree, which they manage with great dexterity. People come from all parts to trade for the fish, bringing plantains, yams, etc., for the fisher-folk, who carry on no cultivation. In Prempeh's time all but the king's own fishermen were excluded, but now there are twenty-five villages around the lake, with a total population of near 10,000. The people were dispersed during the war, and, till lately, were very shy, but have now settled down, and seem a peaceable and quiet lot, lazy as a rule, but generally honest, and extremely honourable in their dealings. Mr. Fergusson speaks in high terms of the Ashantis generally, who are, he says, far and away the best natives of the whole coast, partly owing to the absence of "civilization," but principally to the excellent administration, the people knowing that they can always get justice at Kumasi. The Fantis and Krepis are, on the contrary, described as, each in their way, thorough blackguards. Animal and bird life is scarce round the lake, and even mosquitoes are comparatively few. Monkeys, leopards, a few bush antelopes and pigs, pelicans and kingfishers, the osprey and hawk, are the principal kinds represented. Sandflies are troublesome, but they come out in force only in the early morning and evening. The natives suffer much from fever, but not of a malignant type.

Ancient Gem-workings in Manika.—Mr. A. Vaughan Williams sends us a description of two visits to the neighbourhood of the Chimanimani pass, south of Umtali, in the course of which he paid some attention to the traces of ancient workings for precious stones which seem to have been carried on at a remote period in this district. The pass is a magnificent gorge in the range which separates the territory of the South Africa Company from that of the Portuguese "Mozambique Company," and which rises rapidly from the plains, 3000 feet or more, to an altitude of about 8000 feet. The plains are very fertile, covered with bush and rank tall grass, harbouring buffalo and other game, while the mountain slopes are densely wooded with trees of excellent timber, and well watered with streams, which often form cascades with a sheer fall of 200 feet and more. The ancient workings, of which only the shafts and galleries now remain, there being

no traces of ancient towns or buildings, are situated on the summit of the range, at the headwaters of the Umvumvumba and Manyinga rivers, in a sandstone formation composed of horizontal strata, with veins of quartzite, mica and talc schist, and dykes of diorite. Most of the excavations are in British territory, but some extend across the frontier into the sphere of the Mozambique Company. At the time of his first visit, in 1890, Mr. Williams heard reports of the occurrence of diamonds in the neighbourhood, but regarded them as a romance on the part of natives who had worked in the Kimberley mines. In 1900, however, the report of a discovery of diamonds being again current, he paid a visit to the spot of which he had heard in 1890, and found it to be the place of the supposed discovery. The surface was dotted for miles with fallen-in shafts, which Mr. Williams was at first disposed to attribute to the action of water, the heavy rainfall being absorbed by the porous soil and conveyed underground to the edge

THE UMVUMVUMBA RIVER, MANIKA.

of the plateau along the flat surface of the sandstone. Afterwards he became convinced that such was not the case, as in many instances the "dumps" were plainly visible. The rock specimens collected included crystals of octahedron shape (not diamonds) and other stones, which on examination have proved to be topaz of different colours—a gem well known to the ancients. The features of the native chiefs of the district are said to indicate Arab descent. This discovery certainly seems to confirm the belief that South-East Africa was the quarter whence the gold and precious stones of ancient times were largely procured, though in the case of the gems the argument is less fully supported, owing to the other sources of supply known to the ancients. Mr. Williams speaks enthusiastically both of the climate and the scenic beauties of the country. For eight months in the year the air is sharp and bracing, while before the time of the grass fires a marvellous panorama is spread out before the eye from such summits as

Myamatumba, whence the view extends for a distance of 150 miles. The many waterfalls leaping over the almost continuous line of precipice into the tropical forest below, form a marked element of beauty in the scene. In the summer the short grass of the mountain-tops is enlivened with a profusion of ground orchids, while the forests teem with beautiful varieties of ferns, tree-orchids, climbers, etc. Mosquitoes flourish even at the higher levels, but it is difficult to say whether malaria is endemic, Mr. Williams and his party, which included Mrs. Williams, being already subject to chronic malarial fever. The opinion is, however, expressed that the district will become the sanatorium, as it certainly is the Switzerland, of Rhodesia.

The Capital of Madagascar.—Some diversity of opinion has been elicited by the reported pronouncement of General Gallieni in favour of the virtual removal of the capital of Madagascar from the interior of the island to the coast, which has been unfavourably commented on by those whose interests lie in the direction of the development of Tananarivo. The governor-general has declared it to be his mature opinion that the whole economic future of the island lies in the coast-lands, and that places like Tamatave and Majunga will be called upon to play a *rôle* of increasing importance in this connection in the future. No official action appears to have been taken in the direction of a formal transference of the centre of authority, and Tananarivo will doubtless always remain an important political and military centre, even though the commercial capital may be placed elsewhere.

Journey of a Native Caravan through Somaliland.—A German missionary at Lamu gives, in *Petermanns Mitteilungen* (1902, No. 1), an account of a journey made by a Somali caravan through the little-known interior north of the Tana river. The leader was a Somali who had been in government service, and now applies his savings from time to time to journeys of this kind. Having got together a party, he set out from Kismayu, and, after a wide circuit through the Galla countries along the Abyssinian frontier, finally reached the Rendile country lately traversed by Count Wickenburg (*ante*, p. 216). According to his accounts, the primitive inhabitants of the country are the Wakore, the Rendile (the only Somalis who have not adopted Islam) having been pushed inland by their Mohammedan neighbours. They are said to have expressed a desire for the advent of Europeans. The return journey was made by Kenya, Uganda, and the railway to Mombasa.

Railways in the Stanley Falls Region.—The *Mouvement Géographique* for December 29 last gives a sketch of the proposed route of the more northerly of the two lines of railway which are to be built in the eastern part of the Congo State—that from Stanleyville, just below the Stanley falls, to the Albert Nyanza at Mahagi. Surveys for the line are being executed by a staff of engineers under M. Adam, who has already been some time in the country, and is to remain at work another two years. The proposed route runs at first south of the Chopo river, but crosses this beyond the post of Bafwaboli, and, continuing in a direction slightly north of east, crosses the upper Lindi and strikes the Aruwimi-Ituri near the junction of the Ibina, its southern upper branch. It then follows the south bank of the Ituri and strikes east to Kavalli, then following the crest of the watershed between the Ituri and Lake Albert, until it finally descends the escarpment to reach the lake at Mahagi. A large part of the line will run through the great forest, and the clearance of a track through this will be a work of much labour. For the transport of materials and supplies, it will be necessary to add to the flotilla on the middle Congo. A more recent number of the *Mouvement* (February 2, 1902) gives details of a proposed line for the purpose of turning the Stanley falls and supplying communication between the navigable sections of the river above

and below. This, it is said, will probably be the first scheme to be carried out. Provisional tracings of the route have been made both on the east and west banks of the river, that on the west giving decidedly the shorter mileage. The alternative lines are shown in a map in the number last quoted.

The Position of Insalah.—Reference has already been made (*Journal*, vol. xi. p. 667; vol. xii. p. 412) to the position of Insalah, as given by early and recent travellers, and we are now able to give the result of M. Flamand's observations for the determination of the position. In a note in the *Comptes Rendus* of the Paris Academy of Sciences (vol. cxxxiv. p. 27), he states that on his last journey in the regions of Tademait and Tidikelt (October, 1899–February, 1900) he was able to devote himself to the determination of the geographical positions of the principal points of his route, and particularly to that of Insalah. The determination of the latitude which he made at Insalah was based on six series of circum-meridian observations of the sun taken with a sextant reading to 10″, the mean of the values obtained being 27° 10′ 46″ lat. N. The longitude was determined in two different manners: (1) by means of occultation by the moon of star 65 Belier on January 10, 1900; (2) by observations of the hour angle of the sun with the sextant, from January 6 to 16, 1900, the rate of the chronometer having been deduced from telegraphic comparisons made with the Algiers Observatory, at Tugurt, and Wargla on the outward journey, and at El Golea on the return. The results are as follows:—

	Longitude. In arc.	In time.	
By occultation of 65 Belier	2° 27′ 30″	0h 9m 50s	E. of Greenwich.
By observation of hour angle of the sun ...	2° 28′ 0″	0h 9m 52s	E. of Greenwich.

This shows that the result obtained in 1898 from the surveys of MM. Germain and Laperrine (2° 26′ E.) was fairly correct. The co-ordinates of five other places are also given.

M. Doutté's Journeys in Morocco.—With the support of the French Minister of Public Instruction, the Government of Algeria, the Comité de l'Afrique Française, and the Paris Geographical Society, M. Edmond Doutté last year carried out extensive journeys in Morocco, the preliminary results of which are given in a supplement in the *Bulletin* of the Comité above mentioned (1901, No. 8). M. Doutté traversed in various directions most of the western portion of the kingdom from Tangier to Mogador and the Atlas, and though topographical surveys formed no part of the programme which he had set himself, he devoted considerable attention to the physical features of the country and the varying conditions as regards fertility, vegetation, habitability, and so forth. Geological researches had to be kept in the background, firstly because the time was already occupied with other work, and secondly owing to the suspicion likely to be aroused among the inhabitants by them. Some geological specimens were, however, collected in the Atlas region, and have been submitted to an expert. The resources of the country and their possibilities of development formed a special object of inquiry. As regards the fertility of the soil, of which so much has been said by some writers, M. Doutté considers their views exaggerated, although the plains lying in front of the Atlas in the west are certainly rich. With the doubtful exception of the "argan" tree (order *Sapotaceæ*), from the seeds of which oil is extracted, he considers the agricultural products to be limited to those of Algeria and Tunis. The chief source of wealth to a European power would be, he thinks, apart from unforeseen discoveries, the rearing of cattle and sheep, especially the former. As regards mineral wealth, he is again inclined to take a sober view by reason of difficulties in the way of its exploitation, which the example of Algeria renders it

advisable to take into account. M. Doutté's report also discusses the ethnology of the country, its methods of administration, and other allied subjects. He considers that the policy pursued by Europe in the endeavour to lead Morocco into the paths of civilization, must be one of prudence and friendship. Any attempt to interfere directly with the administration must be avoided, but the people must rather be gradually led towards reform through the development of their wonderful commercial aptitudes, the improvement of agricultural methods, the introduction of simple industries, and the initiation of public works.

Surveys in Africa.—The secretary of the British South Africa Company points out to us that in the small map of Africa which illustrates Sir Thomas Holdich's paper in the *Geographical Journal* for December, all reference to the geodetic survey of Rhodesia has been omitted, although the survey has been in progress since 1897. The omission was purely accidental, as will be apparent to those of our readers who have followed the accounts of the progress of the survey given from time to time in the Monthly Record from the reports of Sir David Gill, the astronomer at the Cape (see *Journal*, vol. x. p. 441; vol. xiv. p. 667; vol. xvi. p. 474; vol. xix. p. 90). The first season (1897) was devoted to reconnaissance, while in 1898 the longitude of Bulawayo was fixed by telegraph signals, and a base-line measured on the water-parting to the east. In 1899 the triangulation was extended northward to Gwelo, progress being also made with the cadastral survey; and in 1900 a new base-line was measured and angles determined at fourteen new stations. With reference to the same map, Major Nathan, governor of the Gold Coast, points out that "the northern boundary of the colony on the 11th parallel should have been shown as already surveyed and demarcated; the telegraph line is from Accra to Cape Coast, and thence to Kumasi, and not from Accra to Kumasi direct; there is also a telegraph line from Cape Coast to Elmina, and thence to halfway between Elmina and Assini, which is now being extended to meet the French line at Assini." The boundaries on other sides are now being surveyed, and a general survey is being carried out, based on traverse lines of the gold-mining district on the west of the colony.

AMERICA.

Physical Geography of Central Ontario.—An elaborate paper on the Geological History of Central Ontario appears in the *Transactions of the Canadian Institute* for August, 1901. The writer, Mr. A. W. G. Wilson, traces the various modifications of surface from the ancient pre-sedimentary floor to the recent period following on the retreat of the Pleistocene ice-sheet. It is, however, only with the processes to which the present surface features are attributable that we are here concerned. Previous to the Pleistocene epoch the rocks had been, for a long interval following the last period of deposition, exposed to atmospheric agencies, which developed a topographic system whose remnants, though partly modified by the ice-sheets and obscured by glacial deposits, are still recognizable. The present features are therefore a product of the operation of two processes, Pliocene and early Pleistocene sub-aërial erosion, and Pleistocene erosion by sheet-glacier ice. In its main topographic features Central Ontario is a lowland bounded by the escarpment-fronts of two "cuestas," and occupied by Lake Ontario and the Georgian bay of Lake Huron with the adjacent land-areas. To the south the cuesta-front runs south of the lake from east of Rochester to Hamilton, thence northward to the Manitoulin islands. The northern cuesta is formed by the Black river strata, and its front runs from near Kingston north-west to Georgian bay, beneath whose waters it still seems to be traceable in the direction of the Manitoulins, the unsubmerged portion being generally about 90 feet high. A ridge of drift-deposits divides

Central Ontario into two drainage slopes, a northern and a southern. The main features of the region are those of an ancient coastal plain, which has passed through a period of planation, followed by one of uplift, dissection, and the development of an adjusted drainage system. After describing certain special features, including a series of rock valleys in the east, and the gorges and valleys of the southern or Niagara cuesta, the writer sums up the recent history as follows. While the ice-sheet was retreating across Ontario, a series of lakes were formed between its front and the highlands to the south and west, covering, in the latter stages, portions of the present land area in Central Ontario. The land was being elevated towards the north-east, so that the old shores are not now parallel to the surface of the existing lakes. Since the withdrawal of the lakes the amount of erosion has been small. The courses of the present streams are in part determined by the valleys of the pre-glacial rivers, in part by the position assumed by the drift-deposits with respect to the retreating ice-sheets, and in part to the control exercised by the Pleistocene lake beach-deposits. Many of the present streams do not by any means fit the valleys in which they flow.

New West Indian Lines.—Two new lines of steamers are announced between the United States and the West Indies. The Kerr Line vessels sail monthly from Halifax, N.S., for Jamaica, carrying passengers and cargo, and on their return from Jamaica carry fruit to New York. The United States Steamship Company, with a fleet of fourteen vessels and having their headquarters at Boston, run to Havana and Porto Rico, connecting with inter-insular steamers of the same line for the other islands, and thence proceeding to Central and South America. This is the first direct line between Boston and the West Indian and South American ports.

AUSTRALASIA AND OCEANIC ISLANDS.

Prof. Gregory's Expedition to Lake Eyre.—Prof. J. W. Gregory has undertaken a scientific expedition to the Lake Eyre basin in South Australia for the purpose of investigating its geological history, and, if possible, throwing light on the native traditions of the former existence of giant animals in that region. The leader is accompanied by Mr. H. J. Grayson and five students of the Geological Department of Melbourne University. Prof. Gregory has been temporarily placed at the head of the Geological Survey of Victoria, with a view to its thorough reorganization.

Cardinal Moran and the Discovery of Australia.—The novel theory started by Cardinal Moran a year or two ago, that the continent of Australia was reached by the celebrated navigator Quiros in 1606, still excites interest among geographical circles in that country, and continues to be warmly debated. We have received a paper, presented on May last to the R.G.S. of Australasia, in which the cardinal endeavours to answer the objections of his critics, without, however, adducing any new arguments of importance in support of his hypothesis. His main argument is still based on the enthusiastic descriptions given by the navigator himself when endeavouring to set forth the value of his discovery, and on the fact that a Spanish ship with a brass cannon made in 1596 appears to have been wrecked at some time or other at Port Curtis, in the Gladstone district of Queensland. The detailed refutation of the theory may be left to the various writers in Australia who have taken up the defence of the orthodox view, and two points only need be alluded to as indicating the insecure nature of the grounds on which the new theory rests. When sailing from the bay of St. Philip and St. James in the land "del Espiritu Santo," after the departure of Quiros, Torres first coasted along the shores of the newly discovered land; then he held a south-west course until a certain latitude was reached, *without gaining sight of land;*

and finally turned north-north-west, by which course New Guinea was in time reached. This fits in perfectly with the supposition that the bay of St. Philip and St. James was in the island of Santo, but is, of course, utterly at variance with the idea that the starting-point was on the coast of Queensland. Yet Cardinal Moran considers that "all this fits in very well with the supposition that we have made regarding Port Gladstone." In order to reach this result, he has to make the gratuitous assumption (which still removes only part of the difficulty) that before sailing south-west, Torres "stood out for the open sea" from some point near the New South Wales frontier. The second point above referred to is the fact that in the manuscript map by Don Diego de Prado (one of Quiros' officers), reproduced by Mr. Collingridge in his 'Discovery of Australia,' we have a drawing of the Bay of St. Philip and St. James, which both in orientation and topographical details shows the closest agreement with the bay on the north side of Santo, as drawn in the latest charts. This should surely be sufficient in itself to settle the question.

Agricultural Capabilities of the Northern Territory, South Australia.—In a paper recently read before the South Australian Branch of the Geographical Society of Australasia, Mr. M. W. Holtze discusses the agricultural capabilities of the northern territory and its consequent fitness for permanent settlement. He endeavours to show that, although a large part of the country is utterly unfit for cultivation, there is yet sufficient suitable land for agricultural purposes to make the country prosperous. In the author's opinion the agricultural land in the northern territory is situated near the sea-coast and on the banks of the rivers flowing to the sea. Plantations should be kept within a belt of some 80 miles wide round the coast, which would give an area of about 80,000 square miles. The rainfall of the coastal parts of the northern territory is shown to closely resemble that of French Cochin China, and the soil and climate appear to be in every way suitable for the cultivation of rice. Other products that might be successfully grown in the northern districts are—sugar, coffee, tobacco, coconuts, indiarubber, jute, ramie, arrowroot, tapioca, sesamseed, and peanuts, besides maize and the usual food and fodder plants and fruits of the tropics. In order that plantations in the northern territory may be a success in the future, the author urges the necessity of a careful selection of soil, sufficiency of capital, and suitable labour.

Minerals in West Australia.—While the total output of minerals for 1899 in this state exceeded all previous records, that of 1900, according to the report of the Department of Mines, shows a decrease from the previous year of £167,906, or about 2·6 per cent. This falling off appears to be confined to lead and gold. The decrease in gold has not been general, however, and the return of 1,580,950 ozs. for 1900 has already been nearly equalled by that for the first ten months of 1901. The yield of coal is increasing, and although there are only three producing collieries, with a total output of about 120,000 tons, information obtained as to the existence of new coal-seams is highly satisfactory. The progress of tin-mining is disappointing, only 823 tons having been obtained in 1900; but West Australia promises to become a large producer of copper. Deposits of this mineral giving every prospect of payable results are found from Kimberley in the north to Phillips river in the south.

POLAR REGIONS.

Exploration of the Kara Sea.—The Russian Hydrographical Expedition of the Ministry of Marine will next summer devote its activity to the exploration of the Kara sea, having last year completed the exploration of the straits leading to that sea. It will be under Colonel Vilkitsky, and will consist of Captain Warneck, five officers, a doctor, and fifty men.

Botanical Expedition to East Greenland.—Supported by a grant from the

"Carlsberg fund," the Danish botanist Kruse has sailed for Angmagsalik, on the East coast of Greenland, for the purpose of studying thoroughly the flora of that coast, especially between Cape Farewell and Scoresby sound. Dr. Kruse, who is accompanied by his wife and child, purposes to make a lengthened stay in East Greenland.

Mr. Steenstrup's Voyage to Disco Island.—On a voyage to Disco in 1898, Mr. K. J. V. Steenstrup investigated the colour of sea-water, employing a long tube closed at the bottom with glass, which was let down into the sea and cut off all side light. He had formerly used for comparison pieces of coloured cardboard, but the colours were too dull compared to those of sea-water, and did not give a continuous series of tints—a defect which is also common to the Forel scale. On this occasion he took with him small glass plates varying in tint from light blue through green to yellow, and these he placed in a holder with a prism attached, which, projecting over the edge of his tube, presented the light through the plates side by side with the water. Having chosen a combination of plates which reproduced most closely the colour of the water at each observation, he noted the numbers attached to them, and on his return to Copenhagen was able to imitate, with the chemicals used by Prof. Forel, the colour of the water in different parts of the sea, and compare it with the specimen of plankton taken at the same time. It was found that with twelve to fifteen pieces of glass every tint of sea-water could be obtained. The plankton was drawn by a pump through a filter of hardened paper placed horizontally between two small glass filters, by which means Mr. Steenstrup obtains, he believes, the exact contents of the water more thoroughly than with a plankton-net, while the chaplets of diatoms remained unbroken. The examination of the samples is as yet incomplete, and at present it can only be said that the well-known fact is confirmed that plankton is more abundant in deep greenish-yellow water than in blue. From Godhavn Mr. Steenstrup rowed along the coast to the Kuganguak valley, which had only once been visited before—by Mr. E. Whymper in 1872. Mr. Steenstrup travelled up it for three days, and found its length to be fully 23 miles. It lies between mountains 3300 to 4900 feet high, and perhaps more. Ferruginous andesite, similar to that discovered years ago at Asuk, was noticed on the southern flank. Kuganguak is the largest river in Disco, though the name is a diminutive, probably in reference to the large river draining the interior of the Nugsuak peninsula. The journey back to Godhavn was made along the shore, where fossils from the Cretaceous and Tertiary beds were collected, and measurements taken of the glaciers, especial attention being paid to "dead" glaciers, that is, those which are buried under such a large mass of detritus that at first sight they seem to be nothing but moraines. Among the glaciers examined were the Kutdlisat, ending at an altitude of 820 feet, with a depth of 200; the Asuk, terminating at a distance of 6½ miles from the shore at a height of 1790 feet; and the most southern of the glaciers of the Skarvefjeld near Disco, which descends to 980 feet. An excursion was also made westwards to the Disco fjord, where Mr. Steenstrup examined eight deep troughs containing glaciers, some descending from the higher lands and by their whiteness indicating a connection with the snowfield above, others "dead," cut off apparently from the snowfield and covered with detritus. Near the Mellemfjord the hottest spring known in North Greenland was discovered, with a temperature of 66° F. At Kudtlisat, Ujaragsugsuk, Erkigtok, and Godhavn the levels of easily recognizable points above the sea were determined for the purpose of detecting any future movements of the coast-line. In the *Meddelelser om Grønland*, Hefte 24, from which the above is taken, there is also a report by Dr. Nicolau on the ferruginous rocks of Disco.

MATHEMATICAL AND PHYSICAL GEOGRAPHY.

Dr. Vaughan Cornish on Waves.—In the lecture to young people, on the subject of Waves, given under the auspices of the Society by Dr. Vaughan Cornish on January 8, the lecturer took as his special subject the question of the length and speed of ocean waves, the figures arrived at in regard to the height of waves having already been published and freely quoted. He said that by noting the time which elapsed between the arrival of successive waves at any point, the length and speed in deep water could be accurately calculated. During storms, waves with periods of from eight to eleven seconds were observed, with lengths from 328 to 620 feet. A ten-second wave was 512 feet long, which was exactly the length of Burlington Gardens. The sides of these waves had an average slope of not less than 1 in 10, or fully as steep as that of most of the roads marked "dangerous to cyclists." A set of such waves would have a height of about 25 feet, but there was generally a "swell" running at the same time, which increased the total rise and fall of the water, and made the waves irregular. The wave-length was, as a rule, determined by the steeper, shorter waves, but when, after a storm, these had become no steeper than the swell, it was this which became in its turn the conspicuous thing at sea, and we had commonly a wave of about fifteen seconds' period, with 1150 feet between the ridges, which is, roughly, the length of St James's Street. The majestic rollers which came in upon our shores from the Atlantic after prolonged gales which had traversed the ocean, had a much greater period. He had observed on one such occasion a series of 139 consecutive breakers with an average period of 19⅓ seconds. The length of these in deep water was more than 1900 feet. Standing at the Piccadilly end of Park Lane, and looking eastwards, let them imagine themselves on the crest of one such oceanic swell; the next crest would be just passing the Walsingham House Hotel on the top of the opposite rise. Three such crests would pass them every minute, travelling at the great speed of more than 68 miles per hour. The depth of the valley in the middle of Piccadilly was such as might occur in the case of one of these long ocean swells, which were, however, seldom so clearly marked as to admit of precise observation at sea. The existence of swells (sufficiently developed to give breakers) travelling with so great a speed had been known for many years. When the hourly velocity of wind in storms was reckoned at more than 100 miles per hour, these velocities for swells had no special significance. A novel interest attached to them now that the greatest recorded hourly velocity on our coasts was said to be 75 miles, which was not much greater than the recorded average velocity of trains of waves which arrived upon our shores as a breaking swell. Among the novelties of the lecture were lantern-slides of the 14-foot model battleships made of paraffin wax which were used by the Admiralty Experiment Works at Haslar, and of the waves they made in the tank. These unique photographs, taken by the lecturer, were shown by kind permission of the Lords of the Admiralty. The forms of waves were illustrated by a number of lantern-slides, all from the original photographs taken by the lecturer in his travels, and their motions were shown by cinematographs taken with the bioscope camera by Mr. C. Urban. One of these, of the rapids of Niagara, was shown in order to illustrate the pulsation of a rapid stream, which is entirely lost in an ordinary photograph. The lecturer concluded with an exhibition of the cinematograph picture of the Severn Bore which was described in the January number of the *Journal*.

Recent Papers on Lakes.—The methods of limnological research, and more particularly the quantitative discussion of observations by the methods of geomorphometry, have now been brought to such perfection that comparatively little room is left for modification by individual investigators—a state of affairs which

must greatly simplify the task of collating the results of workers in different regions, when the time is ripe for finally summing up and elaborating general principles. For the present, work in limnology is properly chiefly restricted to the application of these methods to the survey of special regions, and we have to record two important recent additions to the literature of this branch of the subject. The lakes of Pomerania form the subject of a memoir by Dr. Wilhelm Halbfass, published as an Ergänzungsheft of *Petermanns Mitteilungen*. About 150 lakes have been surveyed by Dr. Halbfass himself, 22 were surveyed by Prof. Keilhack, making 172 in the region east of the Oder, all of which are known with sufficient accuracy to admit of the construction of bathymetrical maps. To these may be added 107 partly surveyed but not fully sounded, giving a total of 279, with a combined area of 504·42 square kilometres. Dr. Halbfass's work, much of which is exhaustive, deals with (1) soundings, (2) variations of level, (3) temperature of water at surface and in the depth, (4) transparency of water, (5) chemical composition, (6) plankton, and (7) nature of bottom. The fifth volume of the scientific publications of the Verein für Erdkunde zu Leipzig consists of a memoir by Dr. Willi Ule on the Würmsee or Starnbergersee, in Upper Bavaria. This lake, which covers an area of about 57 square kilometres, lies within the moraine region at an elevation of 584 metres above the sea, and its survey has been of peculiar interest in revealing the action of secondary causes in modifying its form after its first formation by the damming of a channel on the retreat of a glacier. Dr. Ule's memoir deals with the geology and geomorphology first, and then with the physical conditions of the waters of the lake. A separate atlas contains eight plates of excellent maps and sections.

GENERAL.

The Livingstone Gold Medal.—We record with pleasure the foundation, by Mrs. A. L. Bruce, in memory of her father, Dr. Livingstone, of a gold medal, to be awarded by the Council of the Royal Scottish Geographical Society for exploration

THE LIVINGSTONE MEDAL OF THE ROYAL SCOTTISH GEOGRAPHICAL SOCIETY.

and geographical research. It bears on the obverse a portrait of the great explorer, and on the reverse an allegorical representation of the Spirit of Civilization

bearing the torch of Progress and the olive branch of Peace. The first medal has been awarded to Sir Harry Johnston for his distinguished services as an explorer and administrator in Africa.

The Geographical Association.—The Annual Meeting of the Geographical Association was held at the College of Preceptors on Wednesday January 15, 1902, Douglas W. Freshfield, Esq. (President), occupying the chair. The Honorary Secretary read the annual report, which pointed out the steady growth of the Association and the extension of its work through the publication of a terminal magazine, the *Geographical Teacher*, devoted to questions of geographical education. The Right Hon. James Bryce, M.P., then delivered an address, which is printed on p. 301 ; after which Dr. H. R. Mill, in proposing a vote of thanks to Mr. Bryce, said the great value of it seemed to him to be the way in which the subject had been brought before them, showing the comprehensiveness of geography and setting forth its enormous value as an element of culture. He (the speaker), as a physical geographer, noted with peculiar satisfaction the importance which Mr. Bryce attached to geography as a means of teaching the value of observation. They also had to thank Mr. Bryce for the very fascinating syllabus of an unwritten book, and he did not know any one better fitted than their President to become the author of such a work, which would stimulate a great many of those who could only make rare and short journeys, but who were anxious to make the most of their opportunities in order that they might subsequently give life to what he was sorry to say was very often a dead subject—the teaching of geography. Mr. Freshfield congratulated the Association on the marked and very encouraging advance in its numbers, and on the *Geographical Teacher*. In its main work, that of spreading abroad a correct conception of geography, of insisting on its position both as a science and a mental discipline, of leading teachers first and scholars afterwards to recognize that it is not, as the ignorant suppose, the same as Bradshaw—a mere cataloguing of names or exercise of memory—but the study of the features of the Earth's surface in themselves and as they affect its products and inhabitants, the Association was, he said, not standing still. The advance was not unlike that of a devious stream seeking the points of least resistance—at one moment working a channel in the fossilized beds of ancient universities, at another attacking the soft places in the more modern strata of school boards. At the present time there was not a readership or lectureship in any of our universities sufficiently endowed to allow its occupant to devote himself entirely to scientific studies of the subject such as are common in the universities of Germany, although there seemed some prospect of such a chair being founded at Edinburgh. In the English Provincial Universities, geography, we might reasonably anticipate, would hold a proper place in the scheme of education. Nor could it seriously be believed that its omission, even as a special subject, from the matriculation scheme of the new University of London, a scheme with its Sanskrit and Portuguese, was more than an accidental oversight. By practically excluding geography as a matriculation subject, the Council of this new university might be convicted of taking a course which would have an injurious effect on every middle-class school in the kingdom. Any one who helped to maintain such a decision would be doing an ill-service to his countrymen. As Dr. Mill in his Presidential address to the geographical section of the British Association said last year, the reconstituted University of London occupied the best position in the world for creating a Chair of Geographical Research, situated as it was in the very centre of the comings and goings of all mankind, and in touch with the most complete geographical library and map collection in existence. He concluded with a caution. Let us not be misled in commercial centres into

thinking that tables and statistics of trade were commercial geography; commercial geography was surely reasoned appreciation of what products any region does, or is adapted by nature to afford. It was a key to the development of commerce, to the well-being of the world, and the wealth of the people who understood it best.

Lecture to Teachers on the Use of Maps.—On January 24, Mr. A. W. Andrews gave a lecture at the London School Board to an audience composed mainly of teachers in secondary and elementary schools. The subject was the connected use of maps, and was fully illustrated by numerous lantern-slide maps, wall maps, hand maps, and diagrams, produced by the Diagram Company, showing elevation, rivers and river-basins, climate, vegetation, means of communication, history, commerce, etc. The lecture was much appreciated by the audience, and a useful discussion followed.

Scientific Journey by Dr. Genthe.—We learn from *Petermanns Mitteilungen* that Dr. S. Genthe, a pupil of Dr. Theobald Fischer, who has already made himself known by his work on the Persian gulf, is now on his way home from a three years' journey in North America, the Pacific, and Eastern Asia. In Samoa, where he spent six months, he made important studies of the folk-lore of the people; while in Korea he crossed the Kim Gan Sang (Diamond mountains) by a new route, and collected much information on the monasteries of the country, besides acquiring some old Korean manuscripts and prints. He also paid a visit to Quelpaert, where he ascended the volcanic cone of Halassan (Aukland), and by barometric observations determined its height as 6360 feet.

"Zeitschrift" of the Berlin Geographical Society.—The decision of the Paris Geographical Society two years ago to abandon the dual system in its publications has now been followed by the Berlin Society, which from the beginning of the present year will publish one journal only, to be known as its *Zeitschrift*, in the place of the old *Zeitschrift* and *Verhandlungen*. In its new form the *Zeitschrift* will embody all the matter hitherto contained in the two separate publications, containing, like our own *Journal* and *La Géographie*, in addition to original papers, a record of progress in all branches of geography, as well as reviews of books and other publications. The 'Bibliotheca Geographica' will, however, continue to appear separately as an annual volume. The size of the new publication, which is edited by Captain Kollm, the secretary of the Society, is large octavo, and the first number already issued gives promise that it will be in every way worthy of the high reputation of the Berlin Society. The section entitled "Vorgänge auf geographischen Gebiete" is in this number less full than has usually been the case, but we hope that it will not be permanently reduced, as its completeness was a valuable feature in the old *Verhandlungen*.

New Geographical Publication.—The good work done in the United States, from the point of view of geographical education, by the *Journal of School Geography*, the publication of which has now been continued for five years, is widely known. Some two years ago a second magazine of similar scope and aims was started by the American Bureau of Geography, as the *Bulletin* of that body, which has likewise been of service to those interested in geographical teaching. It has now been decided to avoid unnecessary dispersion of energy by combining forces and replacing the two publications by a new illustrated magazine, to be known as the *Journal of Geography*, the first number of which is issued for January, 1902. The responsible editors are Prof. R. E. Dodge, of Columbia University; Prof. E. M. Lehnerts, of the State Normal School, Winona, Minnesota; and Dr. J. P. Goode, of the University of Pennsylvania; the two former having been editors of the parent magazines. Judging from the prospectus which has been issued, the new journal promises to take a high standing among kindred

undertakings. Besides original articles, illustrated with maps and pictures, it will include notes on current geographical progress, communicated by associate editors; reports on current literature, and on the *impedimenta* of geographical teaching; a department of questions and answers, furnishing teachers with an opportunity of having their difficulties solved; as well as items of personal interest respecting geographical workers. The Journal will be issued monthly (July and August excepted) at the low charge of $1.50 per year, and will be published at Boston by the J. L. Hammett Company.

United States Board on Geographic Names.—In the second report of the United States Board on geographic names, of which a limited number of copies was issued in 1900, but of which a further issue for more general distribution was made in March last, the whole of the decisions of the Board up to date, referring to some four thousand names, have been made public. The greater number of the names are those of places in the United States, but a certain number of foreign names have also been dealt with, decisions having been given in all cases of disputed nomenclature specially brought to the notice of the board. To the former class the R.G.S. system, though adopted in the case of foreign names, does not apply, regard being paid chiefly to local usage. Thus we find Chilkoot, not Chilkut, as the adopted form. Other principles followed, in accordance with which a departure from local usage is sometimes made, are, the use of the forms "burg," "boro," and "center" (for burgh, borough, and centre), the discontinuance of hyphens, the combination of two or more words into one name where practicable, (as in "Eldorado"), and the dropping of "city" and "town" as parts of names. In Russian names the termination "of" is adopted, not "ov" or "off." The following are some of the forms and spellings adopted in the case of foreign names: Fujiyama (not Fushiyama), Krakow (not Cracow or Krakau), Lassa (not Lhassa), Magellan (strait of), Malakka (not Malacca), Pechili (not Chihli), Pekin (not Peking), Tchad (not Chad), Tuamotu (not Paumotu), Yapura (not Japura). It is not quite clear why the French form Tchad is retained, but, apart from this, most of the decisions appear sensible.

OBITUARY.

The Marquis of Dufferin and Ava.

By the death of Lord Dufferin, which occurred on February 12, the Royal Geographical Society loses one of the most distinguished of its Fellows. The only son of the fourth Baron Dufferin and his wife—a granddaughter of Sheridan, the famous dramatist, Frederick Temple Hamilton-Temple-Blackwood was born in 1826, and succeeded to the title in 1841. He was educated at Eton and Oxford, and after serving as one of the lords-in-waiting at court, accompanied Lord John Russell to Vienna in 1855, when the latter tried to arrange terms of peace with Russia for the conclusion of the Crimean War. In 1860 he went out to the near East as British Commissioner to inquire, in conjunction with the representatives of the other European Powers, into the Syrian massacres, and subsequently held various offices of State at home, till, in 1872, he was appointed Governor-General of Canada. This post he held for six years, returning home in 1878, only to be appointed almost immediately British Ambassador at St. Petersburg, whence he was transferred two years later to Constantinople, to conduct the delicate negotiations with the Porte

which arose out of the troubles in Egypt. On the suppression of the revolt under Arabi Pasha, he proceeded to Cairo, and, having effected a settlement there, was appointed Viceroy of India in 1884. Four years later he returned to Europe to become British Ambassador at Rome, and from 1891 to 1896 occupied a similar position at Paris.

Primarily, of course, Lord Dufferin was a great statesman and diplomatist, filling the various important offices to which he was appointed with marked distinction, and receiving numerous honours for his valuable services to the empire. But his many-sided character enabled him to appreciate and sympathize with every movement which tended to the advancement of human knowledge, and he took a warm interest in the work of exploration and geographical science. The brief record of his public career given above shows that he was one of the most widely travelled of men; and whilst in Canada and India he was no mere fixture at Ottawa and Calcutta, but was constantly undertaking extensive journeys with the object of making himself thoroughly acquainted with the countries in which he was the representative of the Crown. He was the author of a charming book of travel entitled 'Letters from High Latitudes,' in which he recorded his experiences on a yachting cruise to Iceland in 1856. In 1857 he became a Fellow of the Royal Geographical Society, of which he was elected President in 1878. His speedy appointment to the ambassadorship at St. Petersburg after his return from Canada, compelled him to resign this office before he had fully entered upon its duties, but he greatly appreciated his election to the presidency. As he himself said at the first of the two evening meetings at which alone he was able to preside, "Although I have no claim whatever to be regarded as a scientific geographer, at all events there is one respect in which I can conscientiously consider myself the equal of any of those who have preceded me, and that is in a sincere and enthusiastic desire to promote geographical research, in a profound conviction of the utility of the functions discharged by this Society, and in a respectful and affectionate sympathy with those brave and gallant men who year by year are sent forth under our auspices."

CORRESPONDENCE.

The Hydrography of the Sobat Region.

On my return to England, I had the honour to write a paper for the Royal Geographical Society on my surveys in the Sobat region, giving some description of our travels, the geographical features of the country, and the people met with. I then expressed it as my opinion that a certain river the late Captain Wellby crossed, at about lat. N. 7° 50′, which he described as "30 yards broad, from 8 to 10 feet deep, flowing about 3 miles an hour, and infested with alligators," was the Gelo, which we had followed. This paper appeared in the *Geographical Journal* of May, 1901. Since my return to England recently from my subsequent expedition—to Lake Rudolf and British East Africa from the Soudan—I see by the September number of the *Journal* that my identifications have led to a certain amount of controversy on the part of Herr Brix Forster in *Globus*. I had ventured to suggest that the Ruzi I. of Captain Wellby was the Akobo, as no other stream could possibly be identified with it in these regions. Herr Forster asks, "How can the Ruzi of Wellby, which flows generally from south to north, be the Akobo, which, as originally explored by Bòttego, was found to have a course from south-east to north-west?" It may be remembered that we had only followed the Akobo for

two days before reaching its junction with the Pibor, and from what I saw of the river systems of that region I felt convinced that the Ruzi which Wellby described as joining the river above mentioned, "30 yards broad," etc., really did nothing of the sort, but flowed by an independent course into the Pibor. My late expedition has fully justified that opinion, and there is absolutely no doubt that the two rivers do not meet, but flow independently into the Pibor—the Akobo at lat. N. 7° 47′ 41″·4 and the Gelo at lat. N. 8° 8′ 45″ (about; I was unable to get observations at the actual junction). We followed the Akobo recently from the Pibor junction generally in a south-easterly direction to lat. N. 6° 44′ 8″, where we left it to strike south. Wellby came upon a large river at about this latitude—N. 6° 40′ I think he gave as the approximate position—which he imagined was his Ruzi I., of which he had seen nothing for many days. It in reality was the Akobo or Juba of Bòttego, and was the same stream as the one we had marched south to from the Gelo the previous year. I venture to state that his original Ruzi I., which he last saw south of the 5th degree north latitude, turning off east—if it does not get lost in the plains altogether—finds its way to Lake Rudolf at times of exceptional flood, after heavy rains. It certainly never flows continuously north as shown on his map, for to do so it would have to penetrate mountain ranges which drain south. That, I think, may be regarded with considerable confidence as being its real fate.

Now for Ruzi II. This stream was first met with by Wellby, he said, about lat. N. 5° 30′, where it was flowing west over an open plain, with nothing to indicate its course. That same stream was met both by Dr. Donaldson Smith and myself subsequently, and I entirely agree with the latter that it does not turn north as shown by Wellby. To do so it would have to run uphill for some 20 or 30 miles before it could obtain the benefit of a down-grade again!—according to my barometric readings. My own impression is—and I think probably Dr. Donaldson Smith will support me—that that stream continues west, until it finally becomes absorbed by the inhospitable plains which it enters. However, further north Wellby came upon another stream, which he imagined to be Ruzi II. again after it had swung from west to north away out over the plains. I am inclined to think that, in reality, he had got on to the stream that drains the escarpment to the east, the tributaries from which flow into the plain in a westerly direction, and then swing north at this point—favoured by the *now* northerly fall in the ground towards the Akobo. He never saw that river again until after reaching the Akobo (which I have previously mentioned he thought was possibly his original Ruzi I.). After proceeding some way up the Akobo, he found two rivers flowing almost parallel to each other and only a few miles apart. He crossed the more westerly one twice in his journey north, and then formed an opinion that the two joined after he had finally crossed the easterly one, or the Akobo. Now, I went to much trouble in attempting to identify his Ruzi II. thereabouts; his Ruzi I. here may be accepted as being the Akobo beyond all shadow of doubt, to my mind. We came across a swampy stream, known to the Anuaks as the Oboth, which is possibly—it is quite impossible to say for certain—joined by the stream met with by Wellby north of 5° 30′ before reaching the Akobo. The Oboth, the Anuaks told us, branches off from the Akobo, is joined by another stream from the south, and the two then flow north close to the Akobo for a time, before swinging west towards the Pibor. This agreed with my idea of the river system, as by our journey up the Akobo it was evident that that river was not joined by any other on the left bank, of the importance of Wellby's Ruzi II. The Ruzi I., therefore, is never joined by the Ruzi II. of Wellby, and there is no "combined Ruzis" to join the river "30 yards broad," etc.;

for I have already shown that the Akobo and Gelo flow by independent courses into the Pibor. My identification of Wellby's river, which he described as "30 yards broad," etc., with the Gelo is questioned on the plea of the great discrepancy in latitude. Wellby met that stream, he said, at lat. N. 7° 50′. Now, what are the various latitudes I obtained when following the Gelo?

(1) Camp 8/5/00. N. 7° 50′ 42″.

(2) Camp 11/5/00. N. 7° 52′ 36″·6, near where we left the Gelo to march to the Akobo; and Patok village, where the Gelo was first struck from the Baro, was N. 7° 44′ 5″.

From the above it will be observed that the discrepancy is not so great as the N. 6° 40′ of Wellby for his Ruzi I.—the Akobo in reality—where he first met the latter. I am still of unshakable opinion that the Gelo and Wellby's river "30 yards broad," etc., are one and the same stream, and that he followed the latter in a north-westerly direction to the Pibor, which is shown in his map as having been reached somewhat to the north of the 8th degree of latitude. The question of longitudes need not be entered into; we are considerably at variance on that point. I have gone rather in detail into the question of the Ruzis, as the Egyptian authorities have been much puzzled, and Colonel Talbot's first question almost on our return was, "What about Wellby's Ruzi?" I have worried the matter out to the best of my ability, and I think the grounds I have given are reasonable ones. It must be remembered that in those level grassy plains over which rivers take the most erratic and unlooked-for courses, Wellby's reasoning could very easily be at fault, as one sees comparatively so little of the actual courses of the streams. I perhaps had better opportunities, but some of my surmises may be incorrect regarding streams not actually followed. With regard to the Akobo and Gelo I have no doubt.

H. H. Austin, Major and Captain R.E.

The Belgian Antarctic Expedition.

There are some historical mistakes in M. Arçtowski's lecture on the Belgian Antarctic Expedition (*Geographical Journal*, October, 1901).

The writer says (p. 355) that Captain de Gerlache's scheme was to undertake *a voyage of adventure*, and that it was one of the members of the council of the Royal Geographical Society (Brussels) who suggested to him the plan of a scientific expedition—"an idea," writes M. Arçtowski, "which made its way in the course of time."

I knew de Gerlache long before M. Arçtowski or any other of the staff of the expedition became acquainted with him, and as I was one of the first to whom he expressed his ideas on the subject, I am in a position to ascertain that *from the very beginning* it was the captain's mind to undertake a scientific expedition. He expressly and repeatedly insisted upon this point—saying, for instance, in his note to the Royal Geographical Society (Brussels) that the expedition, not being a purely geographical one, but having for its object the study of scientific problems in the unexplored area of the antarctic seas, was bound to bring a rich harvest of results. This, I believe, has proved to be the case.

M. Arçtowski also complains (p. 357) about the lack of any written contract between the staff and the leader of the expedition. But this, I remember, was agreed between all of them, and it certainly proved to be mostly to the benefit of de Gerlache's companions, who were free to publish anything on the expedition and its results without obstruction whatever.

I also wonder why, on the chart annexed to M. Arctowski's paper (read in June, 1901), the strait which was discovered and surveyed by the commander and staff of the expedition should be named "Belgica strait," while it was in March, 1900, that, after the suggestion of de Gerlache's companions themselves, and in recognition of his services to science, his own name was given to the strait.

My friend certainly deserved this mark of gratitude, for if the results of the expedition show that every one on board did his duty, there would certainly never have been a Belgian Antarctic Expedition without de Gerlache's continuous exertions from the time he made his project public, to the departure (three years later); and the results of the expedition could not possibly have been collected without the commander's aid and good-will, and without a great deal of nautical skill on his part.

PAUL PELSENEER, D.Sc.
Corresp. Member of the Belgian Academy of Science.

WITH Dr. Pelseneer, I share the opinion of everybody that the Belgian Antarctic Expedition was the work of Commandant de Gerlache. I know what difficulties he had to surmount, and with what perseverance he overcame them, and certainly all the honour of the success of the enterprise is due to him—and to his excellent captain, Mr. Lecointe.

I do not admit the "historical mistakes" which Dr. Pelseneer supposes me to have made in my lecture of June 24, 1901.

As a matter of fact, the first recorded *document* of the expedition is a memoir (in the form of an autographical reprint) entitled "Projet d'organisation d'une expédition belge pour l'exploration de l'Océan Antarctique" [by de Gerlache], presented, October 5, 1894, to the Council of the Royal Belgian Geographical Society by the secretary, M. Du Fief, who had been acquainted with the project of de Gerlache, and had even discussed the question with him for some time. It was after a favourable report on this memoire by MM. Leclercq, Pavoux, and Goblet d'Alviella, that the Geographical Society of Brussels accorded its patronage to the project, in the commencement of November, 1894.

In this memoir, which can be consulted at the Society, there is an historical account of antarctic expeditions, and mention is made of the projects of Baron Nordenskiöld, Dr. Neumayer, and Sir John Murray. On the last page one finds—this page is full of scratched-out words, and has many corrections tacked on—a programme of scientific researches to be undertaken, and, on the page before, mention is made of certain *collaborateurs* from the Observatory. In the *Mouvement Géographique*, of November 25, 1894, we read that "Un groupe de jeunes savants belges, appartenant au monde de la marine, des sciences naturelles, astronomiques et météorologiques, et attachés à plusieurs de nos grands établissements ou services publics, s'occupent de mettre sur pied une expédition . . ." And a few months later, in an article published in *La Réforme* (March 17, 1895), we learn the names of these gentlemen: Lameere, Massart, Prinz, Vincent, Stroobant. The names of these first collaborators are quite sufficient to show that the "plan of a scientific expedition" grew out of a certain *milieu* favourable to the development of such ideas. In consequence, I maintain—until proved of to the contrary—that "the plan of a scientific voyage was suggested to M. de Gerlache."

As the first documents are not sufficiently numerous, there can always remain a difference of opinion, and I think that I am not the only one who does not share that of Dr. Pelseneer. Besides, during the voyage of the *Belgica*, Commandant de

Gerlache often came back to his first idea—the south pole—towards which his courageous, persevering and daring spirit still led him. I was, and I am still, of the opinion that this fixed idea—farthest south—is not compatible with that of an expedition of scientific exploration.

But why does Dr. Pelseneer take exception to the fact that a seaman should imagine a voyage of discovery (which is most natural) rather than one of science?

Secondly, I must draw the attention of Dr. Pelseneer to the fact that it is not only now, but also before the departure of the *Belgica* from Antwerp, and during the voyage, that I "complained" of the lack of any written contract, written instructions, and defined programme for the voyage. Consequently, it would be "a historical mistake" to state that a "lack of written contract was agreed between all" of us.

Lastly, the chart inserted in my paper is a copy of Captain Lecointe's map published in the *Bulletin* of the Geographical Society of Brussels (January, 1900), which is, until now, the only official record of the cartographical work of the Expedition. The Admiralty has already taken into consideration this chart, so that the name of "Belgica strait" was printed in August, 1900, and March, 1901, on the map [1113]: South Shetland and South Orkney. Farther, it is to be regretted that the *Belgica* Commission has not officially communicated the decision of changing the name of the strait to the different geographical institutions and societies, a decision which is contrary to that of the Seventh International Congress for the "Rules for Geographical Nomenclature," but which, I hope, would be accepted by the Admiralty and all geographers, if it were officially known.

HENRYK ARCTOWSKI,
Of the Scientific Staff of the Expedition.

Waldseemüller's "Solidum."

59, Drakefield Road, Upper Tooting, S.W., Feb. 4, 1902.

WITH reference to the interpretation of the word *solidum* in the title of the 'Cosmographiæ Introductio' of Waldseemüller referred to in the interesting article in this month's number of the *Journal* on "The First Map containing the Name America," it may be worth while to point out that Egli, in his 'Nomina Geographica' (2nd edit.), under the entry America, speaks of a globe as the work to which this 'Introductio' was to serve as a companion, and adds that a copy (?) of the segments of this globe, perhaps a unique specimen, is to be found in the collection of Gen. Steinhauser in Vienna. I have ventured to treat Egli's "Ex. der Segmente" as equivalent to "Exemplar der Segmente." Dr. Egli had the bad habit of sometimes using abbreviations without explaining them. Possibly an inquiry addressed to Gen. Steinhauser might clear up this matter.

GEO. G. CHISHOLM.

Glaciation.

"Glaciation" (*Journal*, p. 192) is a term already appropriated by geologists to express the effect on the surface of the Earth of ice. Lately it has been frequently used to express the amount of surface covered by ice. Ought not some definite decision as to which sense is to prevail be come to in order to prevent ambiguity?

D. W. F.

MEETINGS OF THE ROYAL GEOGRAPHICAL SOCIETY, SESSION 1901-1902.

Fifth Ordinary Meeting, January 27, 1902.—Sir T. H. HOLDICH, R.E., K.C.I.E., C.B., Vice-President, in the Chair.

ELECTIONS.—*John Aungier; W. Heywood Brettell; John Sadler Curgenven, M.R.C.S., L.R.C.P.; Major Richard Crawshay; Lionel Rayne Foot; Major-Gen. Sir Alfred Gaselee, G.C.I.E., K.C.B.; John Calcott Gaskin; Harold F. Hall; Commr. Arthur Russell Hulbert, R.N.; William Hesketh Lever; Lieut. Percy Calvert Lord, R.E.; Captain John Talbot Lutley, Imperial Yeomanry; Hugh Macdonald, M.B.; Lieut.-Col. C. Martyr, D.S.O.; Sir Guilford Lindsey Molesworth, K.C.I.E.; Herbert Barrow Montefiore; John J. Nicholl; Frederick Phillips Percival; William Blackstone Rennell; Captain Rokeby-Robinson, D.A.A.G. Head-Quarters Staff; T. Featherstone Smith; Edward Thomas Scammell, F.S.A.; Major B. M. Skinner, R.A. Med. Corps.; Herbert Ruston Sykes, B.A.; W. A. Taylor, M.A., F.R.S.E.; Lewis Norman Way.*

The Paper read was:—

"The Formation of the Maldives." By J. Stanley Gardiner, M.A.

Afternoon Technical Meeting, Wednesday, January 29, *at* 4 *p.m.*—General Sir H. W. NORMAN, G.C.B., G.C.M.G., C.I.E., in the Chair.

The Paper read was:—

"The Artesian Water-Supply of Queensland from a Geographical Standpoint." By W. Gibbons Cox, C.E.

Sixth Ordinary Meeting, February 10, 1902.—G. S. MACKENZIE, ESQ., C.B., Vice-President, in the Chair.

ELECTIONS.—*Byron Brenan, C.M.G.; Sir Euan Cameron, K.C.M.G.; Walter Maximilian De Zoete; Lieut. Arthur J. G. Hargreaves, Somerset L.I.; David Q. Henriques; Frederick Lambert; Allan Gordon McArthur; John Thomas Mearns, M.D.; Lieut. Henry du Bois O'Neill, 6th Batt. King's African Rifles; Reginald Albert Priestley; E. Aubrey Thomas; Earle Wellington Jenke Trevor; Rev. Maxwell Frederick Webb; Arthur Oliver Wheeler, Topographical Surveys Staff, Dept. of Interior, Canada.*

The Paper read was:—

"The Ancient Kingdom of Kongo." By the Rev. Thomas Lewis.

GEOGRAPHICAL LITERATURE OF THE MONTH.

Additions to the Library.

By EDWARD HEAWOOD, M.A., *Librarian*, R.G.S.

THE following abbreviations of nouns and the adjectives derived from them are employed to indicate the source of articles from other publications. Geographical names are in each case written in full:—

A. = Academy, Academie, Akademie.
Abh. = Abhandlungen.
Ann. = Annals, Annales, Annalen.
B. = Bulletin, Bollettino, Boletim.
Com. = Commerce.
C. Rd. = Comptes Rendus.
Erdk. = Erdkunde.
G. = Geography, Geographie, Geografia.
Ges. = Gesellschaft.
I. = Institute, Institution.
Iz. = Izvestiya.
J. = Journal.
k. u. k. = kaiserlich und königlich.
M. = Mitteilungen.
Mag. = Magazine.
Mem. = Memoirs, Mémoires.
Met. = Meteorological.
P. = Proceedings.
R. = Royal.
Rev. = Review, Revue.
S. = Society, Société, Selskab.
Sitzb. = Sitzungsbericht.
T. = Transactions.
V. = Verein.
Verh. = Verhandlungen.
W. = Wissenschaft, and compounds.
Z. = Zeitschrift.
Zap. = Zapiski.

On account of the ambiguity of the words *octavo*, *quarto*, etc., the size of books in the list below is denoted by the length and breadth of the cover in inches to the nearest half-inch. The size of the *Journal* is 10 × 6½.

A selection of the works in this list will be noticed elsewhere in the "Journal."

EUROPE.

Alps. **Coolidge.**

W. A. B. Coolidge. La Catena della Levanna (Alpi Graie Centrali). (Estratto dal *Bollettino del Club Alpino Italiano*, vol. xxxiv., 1901, n. 67, pp. 1–44.) *Illustrations. Presented by the Author.*

Alps. **Penck and Brückner.**

Die Alpen im Eiszeitalter. Von Dr. Albrecht Penck und Dr. Eduard Brückner. Lieferung i. Leipzig: C. H. Tauchnitz, 1901. Size 10½ × 7½, pp. 112. *Illustrations.*

Alps—Mont Iseran. **Coolidge.**

W. A. B. Coolidge, La Légende du Mont Iseran. Étude d'histoire topographique. (Extrait de l'Annuaire du Club Alpin Français. 27e volume, 1900, pp. 1–63.) *Maps and Illustrations. Presented by the Author.*

Alps—Morphology. **Penck.**

Verh. Siebenten Internat. G. Kongresses, 1899, **2** (1901): 232–240.

Die Uebertiefung der Alpen-Thäler. Von Prof. Dr. Albrecht Penck.

Austria. *Sitzb. A.W. Wien* **109** (*Ab. I.*) (1900): 527–651. **Mazelle.**

Mittheilungen der Erdbeben-Commission der Kaiserlichen Akademie der Wissenschaften in Wien. XIX. Die tägliche periodische Schwankung des Erdbodens nach den Aufzeichnungen eines dreifachen Horizontalpendels zu Triest. Von Eduard Mazelle. *With Plan and Diagrams.*

Austria—Bohemia. *Globus* **80** (1901): 345–356. **Zemmrich.**

Das deutsche Sprachgebiet in Süd- und Ostböhmen. Von Dr. J. Zemmrich. *Maps.*

A continuation of the study referred to in the *Journal* for November, 1900 (vol. xvi. p. 553).

Austria—Bosnia. *Globus* **81** (1902): 37–39. **Katzer.**

Die ehemalige Vergletscherung der Vratnica planina in Bosnien. Von Dr. Friedrich Katzer.

Austria—Bosnia and Herzegovina. *B.S.R.G. d'Anvers* **25** (1901): 277–290. **Kòsćak.**

La Bosnie et l'Herzégovine. Par le Dr. Jean Kòsćak.

Austria—Hungary—Canals. *G.Z.* **7** (1901): 545–573. **Sieger.**

Kanäle und Kanalprojekte in Österreich-Ungarn. Von Prof. Dr. R. Sieger.

Austria—Tirol. *Globus* **80** (1901): 356–358. **Jaeger.**

Das Bozener Land. Eine erdgeschichtliche Betrachtung. Von Julius Jaeger.

Balkan Peninsula—Montenegro. *B.S.G. Italiana* **2** (1901): 945–950. **Baldacci.**

Un' escursione archeologica del dott. Roberto Paribeni nel Montenegro, nota del dott. A. Baldacci.

Central Europe—Flora. **Schulz.**

Die Verbreitung der Halophilen Phanerogamen in Mitteleuropa nördlich der Alpen. Von Dr. August Schulz. (Forschungen zur deutschen Landes- und

Volkskunde . . . herausgegeben von Dr. A. Kirchhoff. XIII. Band, Heft 4.) Stuttgart: J. Engelhorn, 1901. Size 9¾ × 6¼, pp. 271–360.

Eastern Europe—Mountain Structure. **Philippson.**
Verh. Siebenten Internat. G. Kongresses, 1899, 2 (1901): 181–191.

Der Gebirgsbau der Ägäis und seine allgemeineren Beziehungen. Von Prof. Dr. A. Philippson.

Europe—Censuses. *Rev. Française* 26 (1901): 654–667, 724–731. **Cilvanet.**

Les Recensements de Population. Par C. Cilvanet.

Europe—Geodesy. ———

Publicationen für die Internationale Erdmessung. Die Astronomisch-Geodätischen Arbeiten des K. und K. Militär-Geographischen Institutes in Wien. XVII. Band. Astronomische Arbeiten. 6. Polhöhen und Azimuth-Messungen auf den stationen Bernstein, Brno, Čebon, Pecný, Sadská, Studený Vrch, Tillenberg, Veliš (nur Polhöhe), Vysoká und Žbán. Herausgegeben vom K. und K. Militär-Geographischen Institute. Wien, 1901. Size 12 × 9½, pp. x. and 206. *Presented by the Institute.*

Europe—Historical. *B.S.G. Italiana* 2 (1901): 976–995. **Garofalo.**

Sulla geografia delle *Galliæ* sotto l'Impero Romano. Nota del Prof. Francesco P. Garofalo.

Europe—Historical Geography. *O Instituto* 48 (1901): 530–536, 819–827. **Garofalo.**

Studi di Geografia Greca. Pelo Prof. F. P. Garofalo.

Discusses the geographical knowledge of the Iberian peninsula possessed by Hecatæus of Miletus and Timæus.

Europe—Hydrography. **Pettersson.**
Verh. Siebenten Internat. G. Kongresses, 1899, 2 (1901): 334–342.

Ueber systematische hydrographisch-biologische Erforschung der Meere, Binnenmeere, und tieferen Seen Europas. Von Prof. O Pettersson. *With Plate.*

Europe—Political. *B.S.G. Rochefort* 23 (1901): 238–243. ———

Un condominium dans l'Europe Centrale: Moresnet. *With Map.*

On a wedge of neutral territory, some 3 miles long, between Belgium and Germany just south of the Dutch frontier.

France. **Maillet and others.**

Résumé des Observations Centralisées par le Service Hydrométrique du Bassin de la Seine pendant l'Année 1899. Par M. Maillet. Versailles, 1900. Size 10¼ × 7, pp. 56.

Observations sur les cours d'Eau et la Pluie Centralisées pendant l'Année 1899. Par M. G. Lemoine, M. Babinet, et M. E. Maillet [7 Plates]. Size 16½ × 11.

France. **Vidal de la Blache.**
Verh. Siebenten Internat. G. Kongresses, 1899, 2 (1901): 498–501.

De l'Habitation sur les Plateaux limoneux du Nord de la France. Par Prof. P. Vidal de la Blache.

France—Ardèche. *Alpine J.* 20 (1901): 504–507. **Anderson.**

The Coupe de Jaujac. By Tempest Anderson. *With Illustrations.*

On a visit to the mountain *massif* on the right bank of the Rhone below Lyons.

France—Beaujolais. *Rev. Scientifique* 17 (1902): 79–82. **Privat-Deschanel.**

Les conditions géographiques de la vie animale dans le Beaujolais. Par M. Paul Privat-Deschanel.

France—Cartography. **Drapeyron.**
Verh. Siebenten Internat. G. Kongresses, 1899, 2 (1901): 897–920.

Enquête sur la première grande Carte topographique, celle de France. Par César François Cassini de Thury. Documents inédits recueillis par le Prof. Ludovic Drapeyron.

France—Gascony. **Saint-Jours.**
B.S.G. Com. Bordeaux 27 (1901): 213–228, 233–246, 253–260.

L'âge des dunes et des étangs de Gascogne. Par M. Saint-Jours. *With Maps.*

France—Gascony. *B.S.G. Com. Bordeaux* 27 (1901): 364–366. **Saint-Jours.**

Au Sujet des eaux de Hourtin et de Lacanau. Par M. Saint-Jours.

On the disputed question of the cause of the decrease in depth of the lakes since the seventeenth century.

France—Gascony. *J. School G.* **5** (1901): 289–293. ——

The Dunes and Landes of Gascony.

Reprinted in part from the Annual Report of the State Geologist (New Jersey) for 1899.

France—Isle of Aix. *B.S.G. Rochefort* **23** (1901): 173–175. **Pawlowski.**

Carte-plan de l'île d'Aix dressée par Cornuau, en 1672, présentée avec une note explicative. Par M. A. Pawlowski.

France—Levelling. **Lallemand.**

Verh. Siebenten Internat. G. Kongresses, 1899, **2** (1901): 32–52.

Le Nivellement Général de la France, ses progrès de 1895 à 1899. Par M. Ch. Lallemand.

France—Lorraine. *B.S.G. de l'Est* **21** (1900): 424–442, 551–574. **Merchier.**

Un coin de Lorraine.—Le Barrois.—Nancy. Par M. A. Merchier.

France—Surveys. **Lallemand.**

Verh. Siebenten Internat. G. Kongresses, 1899, **2** (1901): 72–84.

La Réfection du Cadastre, et la Carte de France. Par M. Ch. Lallemand.

Germany. *Rev. Maritime* **151** (1901): 2184–2194. **Bœufvé.**

Le port de Bremerhaven et les ports secondaires du Weser. Par E. Bœufvé.

Germany.

Deutschland auf den Hochstrassen des Weltwirtschaftsverkehrs. Von Arthur Dix. Jena: Gustav Fischer, 1901. Size 9½ × 6½, pp. x. and 218.

This will be noticed elsewhere.

Germany. *Petermanns M.* **47** (1901): 233–235. **Langhans.**

Die Wassererwerbs-Bevölkerung im Deutschen Reiche, insbesondere die Binnenschiffahrts-Bevölkerung. Von Paul Langhans. *With Map.*

Germany. *Globus* **80** (1901): 142–144. **Marcuse.**

Das Briquetagegebiet von Vic, Deutsch-Lothringen. (Ausflug der Deutschen Anthropologischen Gesellschaft am 6 August.) Von Dr. Julian Marcuse.

This district owes its name to the great accumulations of fragments of baked clay, which seem to have been employed in the salt works carried on here from the earliest times.

Germany—Aurich. **Thiele.**

Die Volksverdichtung im Regierungsbezirk Aurich. Von Dr. Otto Thiele. (Forschungen zur deutschen Landes- und Volkskunde . . . herausgegeben von Dr. A. Kirchhoff. XIII. Band, Heft 5.) Stuttgart: J. Engelhorn, 1901. Size 9½ × 6½, pp. 363–426. *Map.*

The district here dealt with is in the north-west of Hanover.

Germany—Brandenburg and Pomerania. **Hellmann.**

Regenkarte der Provinzen Brandenburg und Pommern sowie der Grossherzogtümer Mecklenburg-Schwerin u. Mecklenburg-Strelitz. Mit erläuterndem Text und Tabellen. In amtlichem Auftrage bearbeitet von Prof. Dr. G. Hellmann. Berlin: D. Reimer, 1901. Size 10½ × 7, pp. 40. *Map.*

Germany—Cartography. **Ruge.**

Verh. Siebenten Internat. G. Kongresses, 1899, **2** (1901): 884–896.

Die Anfänge der Kartographie von Deutschland. Von Prof. Dr. Sophus Ruge.

Germany—Early Trade. **Walter.**

Bericht Ges. Völker- u. Erdk. Stettin (1897–98 u. 1898–99): 21–22.

Arabischen Tauschhandel in Norddeutschland zur Zeit des 9. bis 12. Jahrhunderts. Von Prof. Dr. Walter.

Germany—Eifel. *B.S.G. Lille* **36** (1901): 317–328. **Six.**

L'Eifel, région montagneuse de la rive gauche du Rhin. Par M. Georges Six. *With Illustrations.*

Germany—Glaciation. **Wahnschaffe.**

Verh. Siebenten Internat. G. Kongresses, 1899, **2** (1901): 289–298.

Die Ausbildung und Gliederung der Glacial Bildungen des nord-deutschen Flachlandes. Von Prof. Dr. F. Wahnschaffe.

Germany—Riesengebirge. **Partsch.**

Der Ausflug des XIII. Deutschen Geographentages zu den Glacialablagerungen des Riesengebirges. Von Prof. Dr. J. Partsch. (Sonderabdruck aus der Schlesischen Zeitung.) Size 9 × 6, pp. 20.

Germany—Rivers. *Petermanns M.* **47** (1901): 208–214. **Partsch.**

Memel-, Pregel- und Weichselstrom. Bericht über das grosse Werk des Hochwasser-Ausschusses. Von Prof. Dr. J. Partsch.

A full summary of the results of researches published by the German Water-Office in 1899 (*Journal*, vol. xvi. p. 552).

Germany—Silesia. **Frech.**

Führer für die geologische Exkursion des XIII. Deutschen Geographentages nach Oberschlesien . . . bearbeitet von Prof. Dr. F. Frech. Breslau, 1901. Size 8 × 5½, pp. 20.

On the general geology and coal-deposits of Upper Silesia.

Iceland. *G. Tidskrift* **16** (1901–1902): 58–82. **Thoroddsen.**

Islandske Fjorde og Bugter. Af Dr. Th. Thoroddsen. *With Map.*

This will be specially noticed.

Italy. **Cruickshank.**

Grant Allen's Historical Guides. The Umbrian Towns. By J. W. and A. M. Cruickshank. London: Grant Richards, 1901. Size 7 × 4½, pp. 400. *Plans. Price* 3*s.* 6*d. net.*

Contains, besides introductory notes on the history of Umbria and its monuments, detailed descriptions of Perugia, Assisi, Orvieto, and several smaller towns.

Italy—Lakes. **Agostini.**

Verh. Siebenten Internat. G. Kongresses, 1899, **2** (1901): 259–262.

Bathometrie der Italienischen Seen. Von Dr. Giovanni de Agostini. *With Plate.*

Mediterranean.

Guide to the Eastern Mediterranean. London: Macmillan & Co., 1901. Size 7½ × 4½, pp. xxviii. and 246. *Maps and Plans. Price* 9*s.*

Guide to the Western Mediterranean. London: Macmillan & Co., 1901. Size 7 × 4½, pp. xxvi. and 238. *Maps and Plans. Price* 9*s. Presented by the Publishers.*

The guides of this series which have so far appeared are the subject of a notice in the present number of the *Journal* (p. 366).

Norway—Fjords. *Geolog. Mag.* **8** (1901): 555–558. **Hull.**

On the Physical History of the Norwegian Fjords. By Prof. Edward Hull.

The author is one of those who regard the submarine valleys off the coast of Norway as due to river-action when the land stood at a higher level, but adduces no proofs of this supposition.

Russia. *Mém. Comité Géolog.* **18**, No. 1 (1901): 1–104. **Morozewicz.**

Le Mont Magnitnaia et ses alentours. Par J. Morozewicz. *With Map and Plates.* [In Russian, with abridged French version.]

Mainly a geological study. The mountain lies on the east of the Upper Ural.

Russia. *Verh. Siebenten Internat. G. Kongresses*, 1899, **2** (1901): 263–268. **Shokalsky.**

Le Lac de Ladoga au point de vue thermique. Par Lieut.-Colonel Jules de Schokalsky. *With Plates.*

Russia. *Mém. Comité Géolog.* **18**, No. 2 (1901): 1–79. **Sokolov.**

Die Manganerzlager in den Tertiären Ablagerungen des Gouvernements Jekaterinoslaw. Von Dr. N. Sokolov. *With Maps and Illustrations.* [In Russian, with *resumé* in German.]

Russia. *Verh. Siebenten Internat. G. Kongresses*, 1899, **2** (1901): 810–811. **Tillo.**

Untersuchung der Quellengebiete der Flüsse des Europäischen Russlands. Von General-Leutnant Dr. A. von Tillo.

Russia—Fauna. **Nehring.**

Verh. Siebenten Internat. G. Kongresses, 1899, **2** (1901): 463–466.

Ueber die heutige Fauna der russischen und westsibirischen Steppen in ihrer Beziehung zu der pleistocänen Steppenfauna Mittel-Europas. Von Prof. Dr. A. Nehring.

Russia—Flora. **Krassnow.**
Verh. Siebenten Internat. G. Kongresses, 1899, **2** (1901): 457–462.
Die Flora der südrussischen Steppen, ihre Verbreitung und die Geschichte ihrer Ansiedelung. Von Prof. Andreas Krassnow.

Russian Empire—Area. **Tillo.**
Verh. Siebenten Internat. G. Kongresses, 1899, **2** (1901): 808–809.
Nouvelle détermination de la superficie de l'Empire de Russie. Par Lt.-Général Dr. A. de Tillo.

Southern Europe. **Gordon.**
Verh. Siebenten Internat. G. Kongresses, 1899, **2** (1901): 167–180.
The Crust-Basins of Southern Europe. By Mrs. Ogilvie Gordon. *With Plate.*

Sweden and Norway. *P.I. Civil Engineers* **146** (1901): 229–241. **Bache.**
Peat Fuel in Scandinavia. By Alfred Bache.
The possible yield of the great Swedish peat-bogs has been estimated to be equivalent to 3000 million tons of coal.

Switzerland—Rhone Glacier. **Hagenbach-Bischoff.**
Verh. Siebenten Internat. G. Kongresses, 1899, **2** (1901): 269–278.
Vermessungen am Rhone-Gletscher während 25 Jahren. Von Prof. Ed. Hagenbach-Bischoff.

United Kingdom—Ethnology. *Nature* **65** (1901): 39–40. **Dawkins.**
The Influence of the Mediterranean Peoples in Prehistoric Britain. By Prof. W. Boyd Dawkins, F.R.S.

United Kingdom—Historical. **Sieglin.**
Verh. Siebenten Internat. G. Kongresses, 1899, **2** (1901): 845–876.
Entdeckungsgeschichte von England im Alterthum. Von W. Sieglin.

United Kingdom—Meteorology. *P.R.S.* **69** (1901): 61–85. **Shaw and Cohen.**
On the Seasonal Variation of Atmospheric Temperature in the British Isles and its Relation to Wind-direction, with a Note on the Effect of Sea Temperature on the Seasonal Variation of Air Temperature. By W. N. Shaw and R. Waley Cohen. *With Diagrams.*

United Kingdom—Plymouth. *P.I. Civil Engineers* **146** (1901): 2–42. **Sandeman.**
The Burrator Works for the Water-Supply of Plymouth. By Edward Sandeman. *With Plate.*

United Kingdom—Population. *Rev. G.* **49** (1901): 548–561. **Lavagne.**
Répartition de la population en Angleterre au cours du XIX^e^ siècle. Par Paul Lavagne.

Vosges. *Globus* **80** (1901): 117–122. **Werner.**
Die Seen der Westvogesen. Von L. G. Werner. *With Illustrations.*
A sketch of the morphological and other features of the lakes of the Western Vosges, which are said to be in course of extinction.

ASIA.

Asia. *B.S.G. Com. Paris* **22** (1901): 284–302. **Bonin.**
De Pékin à la Mer Noire à travers l'Asie. Par M. Charles-Eudes Bonin. *Map.*

Baluchistan and Persia. *Mem. Geolog. Surv. India* **31** (1901): 179–302. **Vredenburg.**
A Geological Sketch of the Balúchistán Desert, and part of Eastern Persia. By E. Vredenburg. *With Maps and Plates.*
Though mainly geological, this opens with an instructive sketch of the external physical features of the country.

Cambodia. **Aymonier.**
Le Cambodge. Par Étienne Aymonier. 2 vols. I. Le Royaume actuel. II. Les Provinces Siamoises. Paris: E. Leroux, 1900–1901. Size 11 × 7½, pp. (vol. i.) xxiv. and 478; (vol. ii.) 482. *Maps and Illustrations. Price* 32*s.*
A full and careful description of the country, people, monuments, etc., of Cambodia and neighbouring parts of Siam, based on the author's personal observations and on the work of other travellers. The whole forms a useful compendium of our present knowledge of the countries dealt with.

Central Asia. *M.G. Ges. Wien* **44** (1901): 239–261. **Almásy.**
Reise nach West-Turkestan und in den Centralen Tïen-Shan. Von Dr. Georg v. Almásy.

Ceylon. *B.S.G. Lille* **36** (1901): 358–362. **Évrard.**

Une visite aux ruines de Pollanarouwa (Ceylan). Par A. M. Évrard, S.J.

China.

China. Imperial Maritime Customs. I. Statistical Series: Nos. 3 and 4. Returns of Trade and Trade Reports for the year 1900. Part II. Reports and Statistics for each Port, with Report on Foreign Trade of China. Shanghai: London: P. S. King & Son. 1901. Size 11 × 8½, pp. xxii. and 778. *Map and Diagrams. Presented by the Inspector-General of Chinese Customs.*

China. *J. School G.* **5** (1901): 263–269. **Eitel.**

Some little-known features of China. By Rev. Dr. Eitel.

China—Macao. *B.S.R.G. d'Anvers* **25** (1901): 354–359. **Jacqmin.**

Macao. Par M. L. Jacqmin. *With Illustration.*

China—Mongolia. *Tour du Monde* **7** (1901): 493–528. **Batz.**

Voyage en Mongolie. Par M. le Baron de Batz. *With Map and Illustrations.*

China—Yunnan. *Rev. G.* **49** (1901): 422–437. **Schmidt.**

Le Yun-Nan. Le chemin de fer de Lao-Kay à Yun-Nan-Sen. Par Commandant L. Schmidt. *With Map and Diagram.*

Eastern Asia. *Rev. G.* **49** (1901): 401–421. **Brissé.**

L'Allemagne en Extrême-Orient. Par André Brissé. *With Maps.*

India—Anthropology. **Fawcett.**

Madras Government Museum. Bulletin, vol. iii. No. 3. Anthropology. Nâyars of Malabar. By F. Fawcett. Madras, 1901. Size 8½ × 5½, pp. 185–322. *Illustrations. Price* 2*s.* 3*d.*

India—Assam. *J. Asiatic S. Bengal* **69** (Pt. iii.) (1900): 1–127. **Waddell.**

The Tribes of the Brahmaputra Valley. A Contribution on their Physical Types and Affinities. By L. A. Waddell. *With Plates.*

India—Historical. *J. Asiatic S. Bengal* **70** (Pt. i.) (1901): 29–30. **Hoey.**

Supplement to Note on Vaisali and other places mentioned by the Buddhist pilgrims. By W. Hoey. *With Map and Plate.*

India—Nilgiri Railway. *P.I. Civil Engineers* **145** (1901): 1–43. **Weightman.**

The Nilgiri Mountain Railway. By W. J. Weightman. *With Plate.*

India—Punjab. *J. Asiatic S. Bengal* **70** (Pt. i.) (1901): 1–6. **Maclagan.**

Abū-l-Fazl's account of the Multān Sirkār in the Third Book of the Āīn-i-Akbarī By E. D. Maclagan.

India—Sikkim. *Globus* **80** (1901): 253–259. **Bodsohn.**

Reise im unabhängigen Sikkim (Himalaja). Von P. L. Bodsohn. *Illustrations.*

India—Water-supply. *Mem. Geolog. Surv. India* **32** (1901): 1–88. **Vredenburg.**

Recent Artesian Experiments in India. By E. Vredenburg.

This was noticed in February in the Monthly Record.

Indian Ocean—Maldive and Laccadive Islands. **Gardiner.**

The Fauna and Geography of the Maldive and Laccadive Archipelagoes. Being the Account of the Work carried on and of the Collections made by an Expedition during the years 1899 and 1900. Edited by J. Stanley Gardiner, M.A. Vol. i. Part i. Cambridge: the University Press; London: C. J. Clay & Sons, 1901. Size 11½ × 9, pp. 118. *Illustrations. Price* 15*s. net.*

The scientific results of the expedition described by Mr. Gardiner at the meeting of the Society on January 27 are being published in an exhaustive form in parts, of which the above is the first. The work, which promises to be a credit to the Cambridge University Press, will consist of eight parts (2 vols.) mostly devoted to the zoology of the groups, the first, however, supplying a narrative of the expedition and a valuable sketch of the general geography and structure of the islands.

Japan—Language. **Seidel.**

Grammatik der Japanischen Umgangssprache mit Uebungsstücken und Wörterverzeichnissen. Von A. Seidel. Zweite Auflage. Wien, Pest, Leipzig: A. Hartleben [not dated]. Size 7 × 4½, pp. xii. and 178. *Price* 2 *m. Presented by the Publisher.*

Malay Archipelago—Borneo. **Nieuwenhuis.**
Tijds. K. Ned. Aard. Genoots. Amsterdam **18** (1901): 1013–1121.

Mededeelingen over het vervolg der commissiereis naar Centraal-Borneo. Door Dr. A. W. Nieuwenhuis. Algemeene beschouwingen en gevolgtrekkingen naar aanleiding van de commissiereis naar Centraal-Borneo van Mei 1898 tot December 1900. Door Dr. A. W. Nieuwenhuis.

Extends and continues the account of the journey referred to in vol. xviii. of the *Journal* (p. 87).

Malay Archipelago—Celebes. **Adriani.**
Tijds. Ind. Taal-, Land- en Volkenk. **44** (1901): 215–254.

Mededeelingen omtrent de Toradja's van Midden Celebes, lezing gehouden door Dr. N. Adriani, den 3 Sept. 1900.

Malay Archipelago—Sumatra. **Twiss.**
Tijds. Ind. Taal-, Land- en Volkenk. **44** (1901): 255–285.

Eenige aanteekeningen omtrent land en volk der beoosten de onderafdeeling Kotta VII. gelegen onafhankelijke landen. Door F. Twiss.

Pamir. *G. Tidskrift* **16** (1901–1902): 82–108. **Olufsen.**

Den anden danske Pamirexpedition. Ved O. Olufsen. *With Map and Illustrations.*

Philippine Islands.

El Archipiélago Filipino. Colección de datos geográficos, estadisticos, cronológicos y cientificos, relativos al mismo, entresacados de anteriores obras ú obtenidos con la propia observación y estudio por algunos padres de la Misión de la Compañia de Jesús en estas islas. 2 vols., and Atlas. Washington, 1900. Size 11½ × 8, atlas 15 × 13, pp. (vol. i.) xxvi. and 708; (vol. ii.) xx. and 470. *Maps, Diagrams, and Illustrations. Price* $20.

This fine work will be specially reviewed.

Russia. **Primbault.**
B.S.R.G. d'Anvers **24** (1900): 241–292, 385–446; **25** (1901): 161–232, 360–471.

Promenade au Caucase et dans le Turkestan. Par M. Henri Primbault.

Russia—Caucasia. **Krassnow.**
Verh. Siebenten Internat. G. Kongresses, 1899, **2** (1901): 429–435.

Die Stellung von Kolchis in den feuchten subtropischen Gebieten der Erde. Von Prof. Andreas Krassnow.

Russia—Siberia. *Globus* **80** (1901): 101–103. **Adler.**

Die neuesten russischen Seenforschungen in Westsibirien. Von B. Adler.

Russia—Siberia. **Shokalsky.**
Verh. Siebenten Internat. G. Kongresses, 1899, **2** (1901): 777–780.

Les Travaux des officiers hydrographes russes dans l'Océan Arctique et en Sibérie. Par Lieut.-Colonel Jules de Schokalsky.

Russian Central Asia. *Petermanns M.* **47** (1901): 199–202. **Woeikow.**

Die Seespiegelschwankung zwischen Aralsee und Baraba und die Brücknersche Hypothese. Von Prof. Dr. A. Woeikow.

See note in the *Journal* for November, 1901 (p. 531).

Siam. *G. Tidskrift* **16** (1901–1902): 108–121. **Mortensen.**

Fra den danske videnskabelige Siam Expedition. Af Dr. Th. Mortensen. *With Illustrations.*

Merely a popular account of the expedition.

Tibet—Lhasa. *La G., B.S.G. Paris* **4** (1901): 242–247. **Deniker.**

La première photographie de Lhassa. Par J. Deniker. *Plan and Illustrations.*

Turkey—Symi. *B.S.R.G. d'Anvers* **25** (1901): 257–274. **Hauttecœur.**

L'île de Symi. Par M. Henry Hauttecœur.

AFRICA.

Abyssinia. *La G., B.S.G. Paris* **4** (1901): 217–234. **Le Roux.**

Voyage au Oualläga. Itinéraire d'Addis-Ababâ au Nil Bleu. Par Hugues Le Roux.

This was noticed in the Monthly Record for January (p. 87).

Africa. **Simond.**

Les Français en Afrique au XIX^e^ Siècle. Par Charles Simond. Paris: H. E. Martin. (Not Dated.) Size 13 × 9, pp. iv. and 306. *Price* 12*s*. *Maps and Illustrations.*

An historical sketch of French activity in Africa during the nineteenth century.

Africa—Labour-supply. **Negreiros.**

La Main-d'Œuvre en Afrique. Mémoire présenté au Congrès Colonial International de 1900 à Paris, à la Séance du 3 Août. Par A. d'Almada Negreiros. Paris: A. Challamel, 1900. Size 9 × 6, pp. 36. *Presented by the Author.*

Africa—Medical Geography. *Rev. Française* **26** (1901): 625–639. **Servigny.**

La mission Marchand au point de vue médical. Par J. Servigny.

Africa—Research. *J. African S.* (1901): 17–22. **Johnston.**

Notes on African Subjects of Special Interest. By Sir H. H. Johnston, K.C.B.

A sketch of the various departments of science in which research is needed in Africa.

Africa—Survey. ———

Verh. Siebenten Internat. G. Kongresses, 1899, **2** (1901): 744–745.

Topographical Survey of Africa. Abstract of the Report of Permanent Bureau. *Map.*

Africa—Tsetse Fly Disease. **Koch.**

Ein Versuch zur Immunisirung von Rindern gegen Tsetsekrankheit (Surra). Von R. Koch. (Beilage zum "Deutschen Kolonialblatt," XII. Jahrang, Nr. 24. Berlin, den 15 December, 1901.) Size 10½ × 7½, pp. 4.

Gives details of successful inoculation in the case of two oxen, which, when subject to lengthened tests, have shown themselves completely immune from the tsetse fly disease. The author, however, considers the question still far from settled.

African Islands. *A travers le Monde, Tour du Monde* **8** (1902): 21–22. **Kadoré.**

Juan de Nova et Europa. Deux îlots français du canal de Mozambique. Par Pierre de Kadoré. *With Map.*

Cape Colony. **Gill.**

Report of His Majesty's Astronomer at the Cape of Good Hope, to the Secretary of the Admiralty, for the year 1900. London: Printed by Eyre & Spottiswoode, 1901. Size 12½ × 10, pp. 22.

See note in Monthly Record for January (p. 90).

Central Africa. **Götzen.**

Verh. Siebenten Internat. G. Kongresses, 1899, **2** (1901): 759–766.

Ueber die neuesten Forschungen im Gebiet der Nil-Quellen. Von A. Graf von Götzen.

Congo State. *Mouvement G.* **18** (1901): 523–527. **[Wauters.]**

Exploration de la section Septentrionale de la chaîne des Mitumba le long des lacs Tanganika et Kivu. *With Map.*

This is the account of the journey of MM. Sillye and Siffer referred to in the *Journal* for December (p. 622).

East Africa. *J. African S.* (1901): 98–125. **Hollis.**

Notes on the History and Customs of the People of Taveta, East Africa. By Claud Hollis. *With Illustrations.*

East Africa. **Schoeller.**

Mitteilungen über meine Reise nach Äquatorial-Ost-Afrika und Uganda, 1896–1897. Von Dr. Max Schoeller. Band I. und Band III. (Maps). Berlin: Dietrich Reimer (Ernst Vohsen), 1901. Size 11 × 7½, pp. 262 and 28. *Plates. Presented by the Author.*

This important work will be reviewed elsewhere.

East Africa. **Velten.**

Schilderungen der Suaheli von Expeditionen v. Wissmanns, Dr. Bumillers, Graf v. Götzens, und Anderer. Aus dem Munde von Suaheli-negern gesammelt u. übersetzt von Dr. C. Velten. Göttingen: Vandenhoeck & Ruprecht, 1901. Size 8½ × 5½, pp. 308.

This interesting little book gives for the first time narratives of African travel from point of view of Swahili members of exploring expeditions. Dr. Velten has taken them down in Swahili from the mouths of the narrators, and here presents them to the German public, the Swahili text being published simultaneously.

East Africa—Glaciation. **Meyer.**

Verh. Siebenten Internat. G. Kongresses, 1899, 2 (1901): 767–773.

Heutige und einstige Vergletscherung im tropischen Ost Afrika. Von Prof. Dr. Hans Meyer.

Egypt. **Baedeker.**

Egypt. Handbook for Travellers, edited by Karl Baedeker. Fifth Edition. Leipsic: Karl Baedeker, 1902. Size 6½ × 4½, pp. cxcii. and 408. *Maps, Plans, and Illustrations. Presented by the Editor.*

In this edition the two volumes devoted previously to Lower and Upper Egypt have been wisely compressed into one by judicious curtailment. Maps have been added of the Fayum and of the Nile from Cairo to Assuan, as well as various town plans.

Egypt—Fayûm. *Geolog. Mag.* **8** (1901): 540–546. **Beadnell.**

The Fayûm Depression: A Preliminary Notice of the Geology of a District in Egypt containing a new Palæogene Vertebrate Fauna. By Hugh J. L. Beadnell.

Egypt—Nile. **Claparède.**

Verh. Siebenten Internat. G. Kongresses, 1899, **2** (1901): 748–758.

De quelques particularités de la première et de la seconde Cataracte du Nile. Par Dr. Arthur de Claparède.

Egypt—Nile Reservoir. **Claparède.**

Verh. Siebenten Internat. G. Kongresses **2** (1899): 538–544.

Note sur le grand Barrage du Nil au dessous d'Assouan. Par Dr. Arthur de Claparède.

Egypt—Railways. *P.I. Civil Engineers* **145** (1901): 256–267. **Peacock.**

Light Railways in Egypt. By J. A. W. Peacock. *With Plate.*

Egypt—Suez Canal. **Roux.**

L'Isthme et le Canal de Suez, historique, état actuel. Par J. Charles-Roux. 2 vols. Paris: Hachette et Cie., 1901. Size 10½ × 7, pp. (vol i.) iv. and 516; (vol. ii.) 550. *Maps and Illustrations.*

A carefully compiled work, presenting, from a great variety of sources, the history of the Isthmus of Suez, and all attempts at its canalization, from the time of the ancient Egyptians to the present day.

French Congo. *Questions Dipl. et Colon.* **12** (1901): 586–604. **Aspe-Fleurimont.**

Le Congo français. Une expérience coloniale. Par M. Aspe-Fleurimont.

On the attempt to develop the territory by means of commercial concessions.

French Guinea. *B. Union G. Nord de la France* **22** (1901): 22–43. **Noirot.**

La Guinée française et le Fouta-Djalon. Par M. Noirot.

German Colonies. *J. African S.* (1901): 23–38. **Wright.**

German Methods of Developement in Africa. By C. T. Hagberg Wright.

Contains much detailed information as to the constitution and methods of operation of German Colonial Companies.

German East Africa.

Magila in Picture. A series of Illustrations of the Places and People in the Usambara District, East Central Africa, chiefly in connexion with the Work of the Universities' Mission to Central Africa. London: Office of the Universities' Mission to Central Africa, 1901. Size 7 × 8½, pp. 80. *Map and Illustrations.. Price* 1*s.* 9*d. Presented by the Universities' Mission.*

Ivory Coast. *Rev. G.* **49** (1901): 452–460. **D'Ollone.**

Les populations Anthropophages du Cavally. Par Capitaine D'Ollone.

Ivory Coast. **Thomann.**

Renseignements Colon., Comité l'Afrique Française, Nos. 6 and 7 (1901): 113–156.

A la Côte d'Ivoire: La Sassandra. Par M. Georges Thomann. *With Map.*

A sketch of the geography and ethnology of the Ivory Coast, with accounts of the author's own journeys, extending over several years.

Kamerun. *Deutsch. Kolonialzeitung* **18** (1901): 465–467. **Schulte.**

Zur Eisenbahn Victoria-Mundame. Von Dr. A. Schulte. *With Map.*

Kamerun. *Deutsch. Kolonialblatt* **12** (1901): 742–746. **Stein.**

Expedition des Freiherrn v. Stein.

This is the subject of a note in the Monthly Record (*ante*, p. 218).

Kamerun. *Deutsch. Kolonialblatt* **12** (1901): 741–742. ——

Stationsanlage am Crossfluss. *With Sketch-map.*

Liberia. *Questions Dipl. et Colon.* **12** (1901): 523–531. **Franklin.**

La question de Libéria. Par J. H. Franklin. *With Map.*

Morocco. *La G., B.S.G. Paris* **4** (1901): 235–241. **Weissgerber.**

Itinéraire de Casablanca aux Beni-Meskin. By Dr. F. Weissgerber. *With Map.*

Niger. *B. Comité l'Afrique Française* **11** (1901): 334–336. **Lenfant.**

La navigation du Niger: La flottille du Capitaine Lenfant.

This was noticed in the *Journal* for December (p. 623).

Niger. *Rev. Française* **26** (1901): 640–644. **Lenfant.**

La montée du Niger: Mission Lenfant.

Nigeria—Benin. **Luschan.**

Verh. Siebenten Internat. G. Kongresses, 1899, **2** (1901): 607–612.

Ueber die alten Handelsbeziehungen von Benin. Von Prof. Dr. F. von Luschan.

Portuguese East Africa. *J. African S.* (1901): 126–144. **Spilsbury.**

Expedition from Port Amelia to Lake Nyassa, commanded by Major Spilsbury. *With Map and Plan.*

As far as the Lujenda, Major Spilsbury's route coincided in the main, though with some deviations, with that followed in the reverse direction by Mr. J. T. Last in 1886. The spelling of place-names is unsystematic.

Sahara. *Rev. Scientifique* **16** (1901): 721–723. **Bonnard.**

A propos du Transsaharien. Par Paul Bonnard. *With Map.*

The author favours a line from Bizerta and Bughara to Lake Chad.

Sahara. **Foureau.**

Mission Saharienne Foureau-Lamy. D'Alger au Congo par le Tchad. Par F. Foureau. Paris: Masson et Cie., 1902 [1901]. Size 9 × 6¼, pp. 12 and 832. *Map and Illustrations. Presented by the Author.*

A review of this work appeared in the February number.

South Africa—Kalahari. **Passarge.**

Verh. Siebenten Internat. G. Kongresses, 1899, **2** (1901): 774–776.

Die Hydrographie des nördlichen Kalahari-Beckens. Von Dr. Siegfried Passarge. *With Map.*

Tripoli. **Minutilli**

F. Minutilli. La Tripolitania. Torino: Fratelli Bocca, 1902 [1901]. Size 8½ × 5, pp. viii. and 438. *Map. Presented by the Publisher.*

A useful summary of existing knowledge on Tripoli and its Hinterland, with notes on the people, industries, commerce, the history of the country, etc., etc.

Tunis—Farming. **Beaumont.**

A Travers le Monde. Tour du Monde **7** (1901): 281–284, 345–348, 353–356.

Les grands Domaines franco-tunisiens. Par G. de Beaumont. *With Illustrations.*

On recent attempts to introduce improved methods of farming in Tunis.

West Africa—Fetishism. *B. American G.S.* **33** (1901): 305–317. **Nassau.**

Fetishism, a Government. By R. H. Nassau.

Describes the working of fetishism in the Corisco bay region from long experience as a missionary.

West Africa—Frontiers. *B. Comité l'Afrique Française* **11** (1901): 368–371. ——

Une violation de la frontière entre le Cameroun et le Congo. *With Map.*

Stations established by the Germans on the north bank of the Ngoko in accordance with Dr. Pleyn's mapping of the frontier are said to be really in French territory.

West Africa—Native Law. *J. African S.* (1901): 80–97. **Stopford.**

Glimpses of Native Law in West Africa. By Colonel J. G. B. Stopford.

West Africa—Trade. *J. African S.* (1901): 40–63. **Root.**

British Trade with West Africa. By J. W. Root.

NORTH AMERICA.

Alaska—Cape Nome. *Globus* **80** (1901): 333–334. ——

Das Goldgebiet am Kap Nome.

America—Cartography. **Phillips.**

Library of Congress. Division of Maps and Charts. A List of Maps of America in the Library of Congress, preceded by a list of works relating to Cartography. By P. Lee Phillips. Washington: Government Printing Office, 1901. Size 11½ × 7½, pp. 1138. *Two copies, one presented by the Library of Congress, the other by R. B. Marston, Esq.*

This catalogue will be of much value to students of historical cartography. The arrangement is primarily a subject one, but is chronological within the separate headings. The list includes maps in books and atlases, many manuscript maps, especially of the Revolutionary war, unknown to historians, and a large number of old state and county maps and plans of cities. The attention called to these will thus make many of them available to students for the first time. As regards originals of early maps, the collection is not particularly rich, but references are given to reproductions under the date of the original map. No such references are, however, given either to Kretschmer's atlas, or to the important series of reproductions published by Leroux of Paris in 1893, both of which refer specially to America, and are in the Library of Congress, as appears from the list of works on cartography which precedes the topographical list. Thus the latter contains no entry relating to the Canerio map (1502), of which a reproduction is given in the French collection.

Mexico. *B.S.R.G. d'Anvers* **25** (1901): 299-341. **George.**

Une excursion à travers le Mexique. Par M. Louis George. *With Illustrations.*

North America. **Herbertson.**

Descriptive Geographies from Original Sources. North America. Selected by F. D. Herbertson, B.A. Edited with Introduction by A. J. Herbertson, PH.D. London: A. & C. Black, 1901. Size 7 × 5, pp. xxxvi. and 252. *Illustrations. Price 2s. Presented by the Author.*

One of a series in course of preparation, which should prove of much value from an educational point of view. It aims at providing the student with the personal descriptive element in regard to distant countries, which is not to be found in ordinary text-books, but is essential to a real grasp of the characteristic features of the regions studied. The vast mass of modern literature makes it impossible for the teacher or pupil to draw at first hand from the actual accounts of travellers, but the necessary material is here supplied by a judicious selection of passages of most value for purposes of description, reinforced by illustrations of typical features. The main outlines of the geography are summed up in an introduction to each volume.

United States. *B. American G.S.* **33** (1901): 301-304. **Wilson.**

Topographic Forms of the United States. By Herbert M. Wilson.

Shows how the various topographic forms are illustrated in the maps of the U.S. Geological Survey.

United States—Boundaries. **Moore.**

Verh. Siebenten Internat. G. Kongresses, 1899, **2** (1901): 691-703.

Boundaries of the United States. By Prof. John Bassett Moore.

United States—Colorado. *La G., B.S.G. Paris* **4** (1901): 339-351. **Davis.**

Les Enseignements du Grand Canyon du Colorado. Par W. M. Davis. *With Illustrations.*

Professor Davis's deductions respecting the geological history of the Colorado cañon were summarized in the *Journal* for December (p. 624).

United States—Ethnology. **Powell.**

Seventeenth Annual Report of the Bureau of American Ethnology to the Secretary of the Smithsonian Institution. 1895-96. By J. W. Powell, Director. Part 2. Washington, 1898. Size 11½ × 8, pp. 475–752. *Maps and Illustrations. Presented by the Bureau of American Ethnology.*

Contains a description (with map) of the Navaho Indians of Arizona and New Mexico, their country and houses, by Cosmos Mindeleff; and a full account of the Arizona Archæological Expedition of 1895, by J. W. Fewkes.

United States—Geological Survey.

Twentieth Annual Report of the United States Geological Survey to the Secretary of the Interior, 1898–1899. In Seven Parts. Part ii. General Geology and Paleontology (pp. 954). Part iii. Precious Metal Mining Districts (pp. 596). Part iv. Hydrography (pp. 660). Part v. Forest Reserves (pp. 498). Maps in separate case. Washington, 1900. Size 11½ × 8. *Maps and Plates. Presented by the U.S. Geological Survey.*

United States—Missouri River. **Owen.**
Verh. Siebenten Internat. G. Kongresses, 1899, **2** (1901), 686-690.
The Bluffs of the Missouri River. By Miss Luella Agnes Owen.

United States—Ohio. *Science* **14** (1901): 775-776. **Tight.**
Preglacial Drainage in South-Western Ohio. By W. G. Tight.
The writer supports the deductions lately made by Mr. Fowke as against the criticisms of Prof. A. M. Miller.

United States—Population. *B. American G.S.* **33** (1901): 348-349. **Gannett.**
The Population of the United States by Sex, Nativity, and Race. By Henry Gannett.

United States—Texas. *Science* **14** (1901): 326-328. **Hill.**
The Coast Prairie of Texas. By R. T. Hill.
The writer's observations lead him to believe that between the Trinity and Colorado rivers the Texas plain is rising.

United States—Washington. *Ann. Hydrographie* **29** (1901): 483-502. ———
Die Puget-Sund-Häfen.

CENTRAL AND SOUTH AMERICA.

Argentine Republic. *B. Démograph. Argentin* **2** (1901): 45-68. **Carrasco.**
Cálculo de la población probable de la República al entrar al siglo XX. Por G. Carrasco.
The total population on December 31, 1900, is estimated at 4,794,149.

Argentine Republic. *B.S.G. Italiana* **2** (1901): 995-997. **Gelodi.**
Sulla colonizzazione della Repubblica Argentina. Da una lettera dell' Ing. E. C. Gelodi al socio dott. A. Baldacci.

Argentine Republic. **Hauthal.**
Publicaciones de la Universidad de La Plata. Contribuciones al Conocimiento de la Geologia de la Provincia de Buenos Aires. I. Excursión á la Sierra de la Ventana. II. Apuntes Geológicos de las Sierras de Olavarria. Por Rodolfo Hauthal. No. 1—Julio 1901. La Plata, 1901. Size 10½ × 7, pp. 30. *Map and Illustrations. Presented by the Facultad de Ciencias Fisico-Matematicas de la Universidad de La Plata.*

Argentine Republic. ———
Ministerio de Agricultura. Memoria presentada al Honorable Congreso, Enero de 1899—Octubre de 1900. Buenos Aires, 1900. Size 10½ × 7½, pp. cxxxii. and 670. *Diagrams. Presented by Dr. F. P. Moreno.*

Argentine Republic—Archæology. **Quiroga.**
Adan Quiroga. La Cruz en America (Arqueologia Argentina) Con un prólogo de Samuel A. Lafone Quevedo. Buenos Aires, 1901. Size 9½ × 6½, pp. xxiv. and 280. *Illustrations.*

Brazil. *Export* **23** (1901): 621-623. ———
Die São-Paulo-Ribeira-Bahn. *With Sketch-map.*

Brazil. *Mouvement G.* **18** (1901): 427-430. ———
L'exploitation du haut Guapore. *With Map.*
A Belgian commercial company has obtained a concession on the right banks of the Guapore and Mamore, and is studying the question of the opening of a route *viâ* the Paraguay.

Ecuador—La Plata Island. **Dorsey.**
Archæological Investigations on the Island of La Plata, Ecuador. By George A. Dorsey. (Field Columbian Museum, Publication 56. Authropological Series, vol. ii., No 5.) Chicago, 1901. Size 10 × 6½, pp. 245-280. *Maps and Illustrations.*

Guatemala. *Globus* **80** (1901): 281-284. **Buhle.**
Das Deutschtum in Guatemala. Von Heinz Buhle.

Haiti. *Petermanns M.* **47** (1901): 193-199. **Tippenhauer.**
Beiträge zur Geologie Haïtis. Von L. Gentil Tippenhauer. VI. Das Lignitlager von Maïssade und der Aufstieg zum Zentralplateau von Gonaïves und von Norden aus. *With Map and Plate.*

Magellan Strait. **Nordenskjöld.**

Verh. Siebenten Internat. G. Kongresses, 1899, **2** (1901): 303–306.

Die Landschaftsformen der Magellan-Länder mit besonderer Rücksicht auf die glacialen Bildungen. Von Dr. Otto Nordenskjöld.

Nicaragua. **Davis.**

Hydrography of Nicaragua. By Arthur P. Davis.—Twentieth Annual Report of the U.S. Geological Survey, 1898–99. Part iv. Pp. 563–637. *Map and Plates.*

Includes an investigation into the ship-transit problem, and report on the work of the Nicaragua Canal Commission of 1898.

Paraguay. **Graham.**

A Vanished Arcadia, being some account of the Jesuits in Paraguay, 1607 to 1767. By R. B. Cunninghame Graham. London: William Heinemann, 1901. Size 9 × 6, pp. xvi. and 294. *Map. Price* 9*s.*

Peru. **Haënke.**

Descripcion del Peru. Por Tadeo Haënke. Lima, 1901. Size 9½ × 6½, pp. xiv. and 320. *Portrait.*

Peru. **Moreno.**

Perú. Las Irrigaciones de la Costa. Estudio . . . por Federico Moreno. Lima, 1900. Size 8 × 6, pp. 226.

Peru. **Portillo.**

Las Montañas de Ayacucho y los rios Apurimac, Mantaro, Ene, Perené, Tambo y alto Ucayali. Por el Coronel D. Pedro Portillo. Lima, 1901. Size 11 × 7½, pp. 8 and 136. *Maps and Illustrations.*

Peru. **Sala.**

República del Perú. Ministerio del Fomento. Apuntes de Viaje del R. P. Fr. Gabriel Sala. Exploracion de los Rios Pichis, Pachitea y alto Ucayali y de la región del Gran Pajonal. Lima, 1897. Size 9 × 6½, pp. viii. and 196. *Map and Illustrations.*

Venezuela and British Guiana. **Baker.**

Verh. Siebenten Internat. G. Kongresses, 1899, **2** (1901): 704–706.

Geographical Results of the Venezuela-British Guiana Boundary Dispute. By Marcus Baker.

AUSTRALASIA AND PACIFIC ISLANDS.

Australia. *Verh. Ges. Erdk. Berlin* **28** (1901): 405–421. **Wiedemann.**

Herr Dr. Max Wiedemann, Ergebnisse einer wirtschaftgeographischen Studienreise nach Australien.

Australia. **Wragge.**

Suggestions for the Establishment of a Federal Weather Bureau for the Commonwealth of Australia. By Clement L. Wragge. [1 Sheet.] Size 13½ × 8½.

Australia—Ancient Wreck. **Thomson.**

R.G.S. Australasia (Victoria) **19** (1901): 83–84.

Notes *re* the Supposed Ancient Wreck near Warrnambool. By Captain Wm. C. Thomson.

Old Spanish and Dutch coins of dates 1717 and 1792 have been found near the scene of the wreck, of the history of which nothing is known.

Australia—Capital. ——

New South Wales. Report of the Commissioner on Sites for the Seat of Government of the Commonwealth. Sydney, 1900. Size 13 × 8½, pp. vi. and 96. *Map.*

This was noticed in the *Journal* for November last (p. 538).

Australia—Capital. *R.G.S. Australasia (Victoria)* **19** (1901): 30–38. **Gipps.**

Lake George (New South Wales) as a Site for the Federal Capital of Australia. By F. B. Gipps.

Australia—Water Supply. **McKinney.**

J. and P.R.S. New South Wales **34** (1900): 233–255.

Intercolonial Water Rights as affected by Federation. By H. G. McKinney. *With Map.*

Eastern Pacific. **Pallander.**

The Log of an Island Wanderer. Notes of Travel in the Eastern Pacific. By Edwin Pallander. London: C. Arthur Pearson, 1901. Size 8 × 5½, pp. 320. *Illustrations. Price* 6*s. Presented by the Publisher.*

A popular account of visits to Rarotonga, Tahiti, the Marquesas, and other lands of the Eastern Pacific.

Pacific—Nomenclature. **Luschan.**

Verh. Siebenten Internat. G. Kongresses, 1899, **2** (1901): 393–396.

Vorschläge zur geographischen Nomenklatur der Südsee. Von Prof. Dr. F. von Luschan.

Queensland—Brisbane River. *P.J. Civil Engineers* **145** (1901): 334–339. **Williams.**

On Some Effects of Land Floods in a Tidal River. By C. J. R. Williams. *With Plate.*

South Australia—Northern Territory. **Parsons and Holtze.**

The Northern Territory of South Australia, a brief historical account: pastoral and mineral resources. By the Hon. J. Langdon Parsons. The Capabilities of the Northern Territory for Tropical Agriculture. By Maurice W. Holtze. (Papers read before the Royal Geographical Society of Australia, South Australian Branch.) Adelaide, 1901. Size 8½ × 5½, pp. 28. *Map and Illustrations. Presented by the Royal Geographical Society of Australia, South Australian Branch.*

See note, *ante*, p. 378.

POLAR REGIONS.

Antarctic—Auroras. *Ciel et Terre* **22** (1901): 79–91, 113–123. **Arctowski.**

Sur les variations périodiques des aurores australes observées à bord de la "Belgica." Par H. Arctowski. *With Diagrams.*

Antarctic—Belgian Expedition. **Arctowski and Thoulet.**

Expédition Antarctique Belge. Résultats du Voyage du S.Y. Belgica en 1897–1898–1899 sous le commandement de A. de Gerlache de Gomery. Rapports Scientifiques publiés aux frais du Gouvernment Belge, sous la direction de la Commission de la Belgica. Océanographie. Rapport sur les densités de l'eau de mer observées à bord de la Belgica. Par H. Arctowski et J. Thoulet. Anvers: J. E. Buschmann, 1901. Size 13 × 11, pp. 24. *Map and Illustrations. Presented by M. J. Thoulet.*

This is the first part received by the Society of the scientific results of the voyage of the *Belgica*. The style of the publication is all that could be desired.

Antarctic—German Expedition. **Drygalski.**

Verh. Ges. Erdk. Berlin **28** (1901): 361–363.

Die Deutsche Südpolar-Expedition. Von Prof. Dr. Erich v. Drygalski.

Antarctic—Ice. **Fricker.**

Verh. Siebenten Internat. G. Kongresses, 1899, **2** (1901): 348–353.

Das Treibeis der antarktischen Meere. Von Dr. Karl Fricker.

Antarctic—Scottish Expedition. **Bruce.**

The Scottish National Antarctic Expedition. By W. S. Bruce. Read at the British Association Meeting, Glasgow, 13th September, 1901. Size 11 × 9½, pp. 10. *Map.* (See also *Scottish G. Mag.* **17** (1901): 561–569.)

Arctic. **Dittmer.**

Das Nord-Polarmeer. Nach Tagebüchern und Aufnahmen während der Reise mit Sr. Maj. Schiff "Olga." Von R. Dittmer. Herausgegeben vom Deutschen Seefischerei-Verein. Hannover und Leipzig: Hahn'sche Buchhandlung, 1901. Size 9½ × 6½, pp. xvi. and 362. *Map and Illustrations. Price* 6*s.*

Arctic—Andrée's Expedition. *Globus* **80** (1901): 144–145. **Voigt.**

Wann erfolgte der Untergang der Andréeschen Polarexpedition? Von Dr. Eric Voigt.

The writer thinks that, weighed down by the ice which accumulated during a five-days' snowstorm, the balloon stranded between July 16 and 20, 1897, between Spitsbergen and Franz Josef Land.

Arctic—Currents. **Bryant.**

Verh. Siebenten Internat. G. Kongresses, 1899, **2** (1901): 663–667.

Drift Casks to determine Arctic Currents. By Henry G. Bryant.

Arctic—Ice. *Verh. Siebenten Internat. G. Kongresses*, 1899, **2** (1901): 343–347. **Garde.**
Die Verbreitung des Treibeises in den arktischen Meeren, nach den Arbeiten des Dänischen Meteorologischen Instituts. Von T. V. Garde.

Arctic—Meteorology.
Meteorological and Hydrological Observations, summer of 1898, by the Expedition of Colonel Vilkitzky to the Arctic Ocean. Published by the Chief Hydrographic Department. [In Russian.] St. Petersburg, 1900. Size 11 × 9, pp. vi., 38, and 4.
Ditto, Ditto for summer of 1899. Size 11 × 9, pp. viii. and 58. *Map.*

Arctic—Nansen's Expedition. **Cora.**
Cosmos **12** (1894–96): 212–224, 367–375; **13** (1901): 70–91.
La Spedizione Artica di Fridtjof Nansen (1893–96). Notizie e riflessi di Guido Cora. *With Map.*

Arctic—Norwegian Expedition. **Mohn.**
Verh. Siebenten Internat. G. Kongresses, 1899, **2** (1901): 668–670.
Ergebnisse der meteorologischen Beobachtungen der Norwegischen Polar-Expedition mit der "Fram" 1893–1896. Von Prof. Dr. H. Mohn.

Greenland. **Steenstrup**
Beretning om en Undersøgelsesrejse til Øen Disco Sommeren 1898. Af K. J. V. Steenstrup.—Meddelelser om Grønland, udgivne af Commissionen for Ledelsen af de geologiske og geographiske Undersøgelser i Grønland. 24ste Hefte, pp. 251–321. Kjobenhavn: C. A. Reitzel, 1901. *Maps and Plates. Also separate copy, presented by the Author.*
This is noticed in the Monthly Record (p. 379).

Polar flora. *Die Natur* **50** (1901): 510–512. **Holm.**
Die Flora der "ewigen Schnee- und Eis- Region." Von Herm. Holm.

Spitzbergen—Glaciers. **Geer.**
Verh. Siebenten Internat. G. Kongresses, 1899, **2** (1901): 299–302.
Die Gletscher von Spitzbergen. Von Prof. Gerard de Geer.

MATHEMATICAL GEOGRAPHY.

Cartography. *B.S.Bretonne G.* **19** (1901): 77-89. **Olivier.**
La Cartographie en 1900. Par Edouard Olivier.

Cartography. **Frassi.**
Verh. Siebenten Internat. G. Kongresses, 1899, **2** (1901): 113–119.
La Nouvelle Cartographie Horaire. Par le Prof. Henri Frassi.

Cartography. **Oberhummer.**
Verh. Siebenten Internat. G. Kongresses, 1899, **2** (1901): 85–98.
Ueber Hochgebirgs-Karten. Von Prof. Dr. Eugen Oberhummer.

Cartography. *Verh. Siebenten Internat. G. Kongresses*, 1899, **2** (1901): 65–71. **Penck.**
Ueber die Herstellung einer Erdkarte im Maassstab 1 : 1,000,000. Von Prof. Dr. Albrecht Penck.

Cartography—Methods. **Claparède.**
Verh. Siebenten Internat. G. Kongresses, 1899, **2** (1901): 941–945.
Un nouveau Procédé de Construction des Reliefs, employé par Mr. C. Perron, cartographe à Genève. Communication du Arthur de Claparède.

Geodesy. *Verh. Siebenten Internat. G. Kongresses*, 1899, **2** (1901): 27–31. **Fuss.**
Tafel zur Berechnung der Höhe und des Azimuts der Gestirne. Von V. von Fuss.

Geodesy. *Verh. Siebenten Internat. G. Kongresses*, 1899, **2** (1901): 5–15. **Helmert.**
Neuere Fortschritte in der Erkenntniss der mathematischen Erdgestalt. Von Prof. Dr. F. R. Helmert.

Geodesy. *Verh. Siebenten Internat. G. Kongresses*, 1899, **2** (1901): 16–17. **Shokalsky.**
Sur les Observations du Pendule à seconde en Russie. Par J. de Schokalsky.

Geographical Distances. **Cleeve.**
Verh. Siebenten Internat. G. Kongresses, 1899, **2** (1901): 954–964.
A System of Comparing Geographical Distances. By Major Frcdk. J. S. Cleeve. *With Maps.*

Latitude Variation. **Albrecht.**

Verh. Siebenten Internat., G. Kongresses, 1899, **2** (1901): 18–26.

Die Veränderlichkeit der geographischen Breiten. Von Prof. Dr. Th. Albrecht.

Map Projections. **Stromeyer.**

Verh. Siebenten Internat. G. Kongresses, 1899, **2** (1901): 99–109.

Surface Equivalent Projections. By C. E. Stromeyer. *With Plate.*

Marine Surveys.

Annali Idrografici. Raccolta di Documenti e Notizie circa l' Idrografiá e la Navigazione. Pubblicati per cura dell' Istituto Idrografico della R. Marina. Volume 2°, Anno 1901. Genova, 1901. Size 11½ × 8, pp. 130. *Charts and Plates. Presented by the R. Istituto Idrografico, Genoa.*

Contains reports on marine surveys executed by Italian vessels in various parts of the world.

Movement of the Pole. *G. Tidskrift* **16** (1901–1902): 121–124. **Engell.**

Den terrestriske Nordpols Variation. Af Dr. M. C. Engell.

Surveying Instrument. **Schrader.**

Verh. Siebenten Internat. G. Kongresses, 1899, **2** (1901): 110–112.

Le Tachéographe. Par M. Franz Schrader. *With Diagram.*

Time and Azimuth. *Ann. Hydrographie* **29** (1901): 511–519. **Schrader.**

Die Bestimmung von Ortszeit und Azimut aus gleichen Sonnenhöhen. Von Dr. C. Schrader.

On a shortened method rendered possible by the use of new tables given in the *Nautische Jahrbuch* for 1903.

PHYSICAL AND BIOLOGICAL GEOGRAPHY.

Acoustic Phenomena. *Sitz. A.W. München Journal* (1901): 211–263. **Günther.**

Akustisch-Geographische Probleme. Von Siegmund Günther.

In this second instalment of his study of natural acoustic phenomena (cf. *Journal*, vol. xviii. p. 114), the author discusses fully, first the musical notes given forth by valleys, woods, rocks, etc., and secondly, simple detonations, such as those associated with earthquakes.

Arid Regions. **Hilgard.**

Verh. Siebenten Internat. G. Kongresses, 1899, **2** (1901): 555–561.

Characteristics of Soils in the Arid Regions. By E. W. Hilgard.

Cosmogony. *Petermanns M.* **47** (1901): 217–225. **Ratzel.**

Die Kant-Laplacesche Hypothese und die Geographie. Von Prof. Dr. Friedrich Ratzel.

The writer considers that the Kant-Laplace, or more correctly the Laplace, hypothesis cannot be considered the sole possible explanation of existing conditions from the point of view of geography.

Cosmography. *P.R. Irish A.* **6** (1901): 457–464. **Close.**

Remarks on a Cosmographical Tractate in the Irish Language in the Library of the Royal Irish Academy. By Rev. Maxwell H. Close.

The existing manuscript is in great part an Irish version of a work by Messahalah, a Jew of Alexandria (eighth century).

Dust-rain. *Sitzb. A.W. Berlin* (1901): 612–613. **Klein.**

Resultate der Untersuchung der Proben des am 10. bez. 11. März 1901 in Italien, Österreich und Deutschland gefallenen Staubregens. Von C. Klein.

Geology—Laterite. **Lenz.**

Verh. Siebenten Internat. G. Kongresses, 1899, 2 (1901): 241–245.

Zur Lateritfrage. Von Prof. Dr. Oskar Lenz.

Geology and Palæontology. **Zittel.**

History of Geology and Palæontology to the end of the Nineteenth Century. By Karl Alfred von Zittel. Translated by Maria M. Ogilvie-Gordon. London: Walter Scott, 1901. Size 7½ × 5, pp. xiv. and 562. *Portraits. Price* 6*s. Presented by the Publisher.*

The original work was brought out in Germany in 1899, having been first entrusted by the Bavarian Academy of Sciences to Julius Ewald of Berlin, and after his death to

the present author. It has been slightly abridged in the translation, but supplies a useful sketch of the progress of geological science from its first beginnings onwards, not only in Germany, but in other countries also.

Geomorphology. **Davis.**
Verh. Siebenten Internat. G. Kongresses, 1899, **2** (1901): 221–231.
The Geographical Cycle. By Prof. W. M. Davis.

Geomorphology. **Lapparent.**
Verh. Siebenten Internat. G. Kongresses, 1899, **2** (1901): 213–220.
La Question des Pénéplaines envisagée à la lumière des faits géologiques. Par M. A. de Lapparent.

Glaciers. **Finsterwalder and Muret.**
Commission Internationale des Glaciers. Les variations périodiques des Glaciers. Sixième Rapport, 1900, rédigé par le Dr. Finsterwalder et E. Muret. (Extrait des *Archives des Sciences physiques et naturelles*, t. xii., 1901.) Genève: Georg & Cie, 1901. Size 9 × 6, pp. 28.

Ice Caves. *Monthly Weather Rev.* **29** (1901): 366–371. **Kimball.**
Ice Caves and Frozen Wells as Meteorological Phenomena. *Also separate copy, presented by the Author.*
This was noticed in February in the Monthly Record.

Limnology. **Halbfass.**
Verh. Siebenten Internat. G. Kongresses, 1899, **2** (1901): 246–251.
Systematische internationale Seenforschung. Von Dr. W. Halbfass.

Limnology. *La G., B.S.G. Paris* **4** (1901): 108–119, 172–189. **Rabot.**
Revue de Limnologie, 1900–1901. Par Charles Rabot. *Also separate copy, presented by the Author.*

Limnology—Seiches. **Forel**
Verh. Siebenten Internat. G. Kongresses, 1899, **2** (1901): 255–258.
Les Seiches des Lacs. Par le Prof. Dr. A. Forel.

Meteorology—Methods. **Wrangell.**
Verh. Siebenten Internat. G. Kongresses, 1899, **2** (1901): 367–369.
Methode zur bequemeren Messung von Serial-Temperaturen. Von F. Baron von Wrangell.

Oceanography—Baltic Sea. **Westphal.**
Verh. Siebenten Internat. G. Kongresses, 1899, **2** (1901): 53–64.
Das Mittelwasser der Ostsee. Von Prof. Dr. A. Westphal. *With Diagrams.*

Oceanography—Deposits. **Thoulet.**
Verh. Siebenten Internat. G. Kongresses, 1899, **2** (1901): 354–364.
Classification des Fonds sous-marins et considérations relatives à la construction d'une carte lithologique des côtes de France. Par le Prof. J. Thoulet.

Oceanography—Nomenclature. **Krümmel.**
Verh. Siebenten Internat. G. Kongresses, 1899, **2** (1901): 379–386.
Die Einführung einer einheitlichen Nomenklatur für das Bodenrelief der Oceane. Von Prof. Dr. O. Krümmel.

Oceanography—Nomenclature. **Mill.**
Verh. Siebenten Internat. G. Kongresses, 1899, **2** (1901): 387–392.
On the Introduction of a Systematic International Terminology and Nomenclature for the forms of Sub-Oceanic Relief. By Dr. Hugh Robert Mill.

Oceanography—Pola Expedition. **Natterer.**
Verh. Siebenten Internat. G. Kongresses, 1899, **2** (1901): 326–333.
Ueber chemisch-geologische Arbeiten der "Pola" Expeditionen. Von Prof. Dr. K. Natterer.

Oceanography—Tides. **Börgen.**
Verh. Siebenten Internat. G. Kongresses, 1899, **2** (1901): 132–147.
Ueber den gegenwärtigen Stand der Gezeitenforschung und die Nothwendigkeit ihrer Ausdehnung auf den freien Ocean. Prof. Dr. C. Börgen.

Phyto-geography. **Drude.**
Verh. Siebenten Internat. G. Kongresses, 1899, **2** (1901): 439–441.
Ueber die Ausbildung der pflanzengeographischen Kartographie. Von Prof. Dr. Oscar Drude.

Phyto-geography. **Warburg.**
Verh. Siebenten Internat. G. Kongresses, 1899, **2** (1901): 442–448.
Einführung einer gleichmässigen Nomenklatur in der Pflanzengeographie. Von Prof. Dr. O. Warburg.

Rivers. *P.I. Civil Engineers* **146** (1901): 216–222. **Hearson.**
A Comparison of the Flow of Water in a River with that in a Small-Scale Model of the River. By T. A. Hearson.

Terrestrial Magnetism. **Tillo.**
Verh. Siebenten Internat. G. Kongresses, 1899, **2** (1901): 129–131.
Sur la Relation qui existe entre la Repartition des Eléments magnétiques et la Distribution générale des Mers et de la Température moyenne à la surface du Globe. Par Lieutenant-General Dr. A. de Tillo.

Tidal Phenomena. *B. American G.S.* **33** (1901): 318–324. **Brownlie.**
The Solution of the Problem of the Tidal Bore. By Alexander Brownlie.
The writer puts forward a theory based on his observations on the bore of the Petitcodiac, New Brunswick.

ANTHROPOGEOGRAPHY AND HISTORICAL GEOGRAPHY.

Ancient Geography—Ptolemy. **Müller.**
Claudii Ptolemæi Geographia e codicibus recognovit, prolegomenis, annotatione, indicibus, tabulis instruxit Carolus Müllerus. Voluminis primi pars secunda. Paris: A. Firmin-Didot, 1901. Size 10½ × 7½, pp. 571–1023.
Claudii Ptolemæi Geographia. Tabulæ xxxvi. a Carolo Mullero instructæ. Paris: Firmin-Didot, 1901. Size 15½ × 12.
Students of ancient geography will welcome the appearance of a second part of Müller's Ptolemy, the first of which was issued so far back as 1883. The work has been taken up, since the original editor's death, by Dr. C. T. Fischer, but the greater part of the notes in the present part are still by Müller. It embraces books 4 and 5 of the geography, dealing with Africa and Western Asia. The atlas gives a useful comparative view of Ptolemy's geography of the various countries side by side with the modern maps.

Anthropogeography. **Meitzen.**
Verh. Siebenten Internat. G. Kongresses, 1899, **2** (1901): 483–497.
Die verschiedene Weise des Uebergangs vom Nomadenleben zur festen Siedelung bei Kelten, Germanen und Slaven. Von Prof. Dr. Auguste Meitzen. *With Plates.*

Commercial Geography. **Adams.**
A Text-Book of Commercial Geography. By Cyrus C. Adams. New York: D. Appleton and Co., 1901. Size 8 × 5½, pp. xvi. and 506. *Maps and Illustrations. Presented by the Publishers.*
The main facts and principles of commercial geography are here clearly put forward, especial prominence being given to the commercial relations of the United States, the book being primarily intended for use in America. Considerations of space have perhaps led in parts to too great compression, and the treatment of African commerce is hardly adequate. On the whole, however, the facts are well up to date.

Commercial Geography—Pearl Fisheries. **Collett and Donnan.**
J. Ceylon Br. R. Asiatic S. **16** (1901): 165–197.
Pearl Oysters and Pearl Fisheries. By O. Collett.
Remarks upon some of the questions referred to in Mr. Collett's paper on "Pearl Oysters and Pearl Fisheries," by Captain J. Donnan.

Commercial Geography—Tea. **McEwan.**
Verh. Siebenten Internat. G. Kongresses, 1899, **2** (1901): 449–456.
The Geographical Distribution of the Tea Plant in Growth and of its product in consumption. By John McEwan. *With Map.*

Economic Geography. **Rehbock.**
Verh. Siebenten Internat. G. Kongresses, 1899, **2** (1901): 545–554.
Der wirthschaftliche Werth der Subtropen in seiner Abhängigkeit von der Wasserfrage. Von Prof. Th. Rehbock.

Ethnology. *Verh. Ges. Erdk. Berlin* **28** (1901): 356–359. **Boas.**
Die Jesup-Nordpacifische Expedition. Von Prof. Dr. Franz Boas.

Ethnology. *Verh. Siebenten Internat. G. Kongresses*, 1899, **2** (1901): 678–685. **Boas.**
The Jesup North Pacific Expedition. By Prof. Dr. Franz Boas.

Ethnology. *Verh. Siebenten Internat. G. Kongresses*, 1899, **2** (1901): 586–597. **Wilser.**
Rassen und Völker. Von Dr. Ludwig Wilser.

Ethnology—Aryans. **Ratzel.**
Verh. Siebenten Internat. G. Kongresses, 1899, **2** (1901): 575–585.
Der Ursprung der Arier in geographischem Licht. Von Prof. Dr. Friedrich Ratzel.

Historical—Christianity. *Sitzb. A.W. Berlin* (1901): 810–845. **Harnack.**
Vorstudie zu einer Geschichte der Verbreitung des Christenthums in den ersten drei Jahrhunderten. Von Adolf Harnack.

Historical—Early Globe. **Estreicher.**
Tad. Estreicher. Globus Biblioteki Jagiellońskiej z początku w. XVI. (Ein Erdglobus aus dem Anfange des XVI. Jh. in der Jagellonischen Bibliothek). Vorgelegt den 15 Januar 1900. (Bulletin International de l'Academie des Sciences de Cracovie Mars 1900.) Size 9 × 6, pp. 96–105. [Also version in Polish, pp. 18.] *Illustration. Presented by the Author.*
See note in *Journal* for August, 1901 (vol. xviii. p. 220).

Historical—Ophir. **Keane.**
The Gold of Ophir, Whence brought and by Whom? By Professor A. H. Keane. London: Edward Stanford, 1901. Size 8½ × 5½, pp. xviii. and 244. *Price 5s. net. Presented by the Publisher.*
A review of this appears in the present number (p. 361).

Historical—Sea-mile. **Wagner.**
Verh. Siebenten Internat. G. Kongresses, 1899, **2** (1901): 877–883.
Die Realität der Existenz der Kleinen Mittelmeer-Meile auf den italienischen Seekarten des Mittelalters. Von Prof. Dr. Hermann Wagner.

History of Geography. **Günther.**
Verh. Siebenten Internat. G. Kongresses, 1899, **2** (1901): 819–844.
Der Humanismus in seinem Einfluss auf die Entwickelung der Erdkunde. Von Prof. Dr. Siegmund Günther.

Industries—Distribution. **Halle.**
Verh. Siebenten Internat. G. Kongresses, 1899, **2** (1901): 516–528.
Die Vertheilung der Industrie auf die klimatischen Zonen. Von Prof. Dr. von Halle.

Political Geography. *Rev. G.* **49** (1901): 501–514. **Deschamps.**
La France et l'Angleterre devant l'Islam. Par Léon Deschamps. *With Map.*

Population Maps. **Hettner.**
Verh. Siebenten Internat. G. Kongresses, 1899, **2** (1901): 502–510.
Ueber bevölkerungsstatistische Grundkarten. Von Prof. Dr. Alfred Hettner. *Plate.*

BIOGRAPHY.

Chaix. *Mem. S.G. Genève* **40** (1901): 73–84, 111–119. **Chaix.**
Notice sur les Travaux de Paul Chaix. Par Émile Chaix. *With Portrait.*
Catalogue des principales publications de Paul Chaix. Par Émile Chaix.

D'Albertis. *Riv. G. Italiana* **8** (1901): 628–632. **Mochi.**
Di Luigi Maria D'Albertis e della sua opera scientifica. Cenni del Dott. Aldobrandino Mochi.

Kingsley. *J. African S.* (1901): 1–16. **Green.**
Mary Kingsley. By Mrs. J. R. Green.

Nordenskiöld. *Nature* **64** (1901): 450–452. **Bruce.**
Prof. Baron Adolf Erik von Nordenskjöld. By W. S. Bruce.

Nordenskiöld. *Deutsche G. Blätter* **24** (1901): 80–95. **Lindeman.**
Adolf Erik von Nordenskiöld. Von Moritz Lindeman. *Also separate copy, presented by the Author.*

GENERAL.

Geography. **Redway.**

The New Basis of Geography. A Manual for the Preparation of the Teacher. By Jacques W. Redway. New York: the Macmillan Co.; London: Macmillan & Co., 1901. Size 8 × 5½, pp. xiv. and 230.

This is reviewed elsewhere (*ante*, p. 368).

Geography and History. **Kretschmer.**

Verh. Siebenten Internat. G. Kongresses, 1899, **2** (1901): 923–930.

Die Beziehungen zwischen Geographie und Geschichte. Von Dr. Konrad Kretschmer.

Malaria. *C. R. l.* **133** (1901): 457–459. **Billet.**

Sur l'apparition simultanée des moustiques du genre *Anopheles* et des premiers cas de paludisme dans la région de Constantine. Note de M. A. Billet.

Metric System. **Mill.**

Verh. Siebenten Internat. G. Kongresses, 1899, **2** (1901): 120–124.

On the Adoption of the Metric System of Units in all Scientific Geographical Work. By Dr. Hugh Robert Mill.

Palestine and Egypt.

Guide to Palestine and Egypt. London: Macmillan & Co., 1901. Size 7 × 4½, pp. xx. and 270. *Maps and Plans. Presented by the Publishers.*

This is noticed in the present number with other guides of the same series (p. 366).

Yellow Fever. *Rev. Scientifique* **16** (1901): 686–690.

La fièvre jaune et les moustiques.

NEW MAPS.

By E. A. REEVES, *Map Curator*, R.G.S.

EUROPE.

England and Wales. **Ordnance Survey.**

Ordnance Survey of England and Wales:—Revised sheets published by the Director-General of the Ordnance Survey, Southampton, from January 1 to 31, 1902.

6-inch—County Maps:—

Bedfordshire, 1 S.E., 3 S.E., 4 N.E., S.W., S.E., 7 N.W., S.W., 12 N.W., N.E., S.W., S.E., 13 S.W., 15 N.E., S.E., 16 N.W., S.E., 17 N.E., S.E., 18 S.W., S.E., 20 N.E., S.E., 21 S.W., 22 N.W., N.E., S.W., 25 N.W., S.W., 28 S.E., 29 N.E., S.W., 31 (N.E., S.E.), 32 S.W. **Cardiganshire,** 1 N.W., N.E. **Huntingdonshire** (Det.), 13 S.W. **Merionethshire,** 17 N.W., 24 N.W., S.W., 37 N.E., 38 S.E., 39 S.W., 47 S.W., 48 N.W., N.E. **Monmouthshire,** 18 N.W., S.W., 23 S.W., 28 S.W. **Montgomeryshire,** 2 S.W., 12A S.E., 12 S.W., 25 S.W. **Staffordshire,** 36 N.W., 37 N.E. **Wiltshire,** 55 S.E., 72 S.W. (74 N.W., and 74A N.E.) 1*s. each.*

25-inch—County Maps:—

Cambridgeshire, III. 13; V. 4; VI. 1, 5, 6, 7, 8, 11, 12, 16; IX. 16; XI. 4, 8; XII. 1, 2, 5, 6, 9, 13; XV. 4; XVI. 2, 3, 5, 6, 7, 9, 10, 13; XX. 4, 8, 12; XXI. 1; XXXIII. 1; XLIV. 11; XLV. 6. **Dorsetshire,** III. 11, 12, 15; VII. 3, 4, 7, 12, 15, 16; XIII. 3, 7, 8, 11, 12, 16; XXIII. 2, 3, 4, 6; XXXV. 16; XLIV. 1; LVII. 13. **Gloucestershire,** I. 16; III. 8, 10, 11, 12, 15, 16; IV. 1, 2, 3, 9, 10, 13; VI. 7; VII. 2, 5, 6; VIII. 6. **Huntingdonshire,** II. 16; XIX. 14; XXIII. 1; XXVII. 11; XXVIII. 6. **Monmouthshire,** XV. 1, 2, 5, 13; XXI. (1 and 2), 5; XXVI. 9; XXXI. 13; XXXIII. 4. **Montgomeryshire,** XVI. 1, 3, 4, 5, 6, 7, 8, 9, 11; XVII. 1; XXI. 8; XXII. 5; XXXIII. 1, 5, 6; XXXIV. 4. **Shropshire,** III. 16; IV. (9 and 5), 13; IX. 4, 8, 11, 14, 15; X. 1, 5; XV. 7, 8, 12, 16; XVI. 1 (2 and 3), 6, 8, 10, 11, 12, 16; XVII. 5, 9, 13; XXI. 16; XXII. 4, 6, 8, 9; (XXIII. 4 and XXIV. 1); XXIII. 9, 10, 13, 14, 15; (XXIV. 1 and XXIII. 4); XXVII. 13, 14, 15; XXVIII. 8; XXIX. 4, 7, 8, 9, 11, 14, 15, 16; XXX. 1, 2, 4, 5, 6, 7, 9, 10; XXXII. 4, 7, 8, 11, 12; XXXIII. 1, 2, 3, 6. **Staffordshire,** XLV. 1; XLVI. 3, 12, 15, 16; LIII. 13; LIV. 14. **Warwickshire and Do.** (Det.); I. 14; L. 1, 2, 3, 10, 12; LIII. 6. **Worcestershire and Do.** (Det. No. 3); XLIII. 10 (areas of Church Honeybourne Parish only), 11, 15, 16; XLIV. 2, 3, 4, 8, 12; XLV. 13; L. 5 (areas of Broadway Parish only); LII. 1, 5, 9. 3*s. each.* (*E. Stanford, London Agent.*)

England and Wales. **Geological Survey.**

MEMOIRS:—Berkshire, Water Supply of, 3*s.*
(*E. Stanford, London Agent.*)

Europe. **Barrère.**

Europe. Scale 1 : 4,500,000 or 71 stat. miles to an inch. Paris: H. Barrère, 1901. 2 *sheets.*

A co'oured general map showing political divisions, steamer routes and railways. The latter, however, are not altogether accurate; for instance, a line is shown as opened from Bergen to Christiania, while, as a matter of fact, this line runs no further than Vossevangen at the present time.

Europe. **International Geological Commission.**

Carte géologique internationale de l'Europe. Scale 1 : 1,500,000 or 23·7 stat. miles to an inch. Livraison iv. Berlin: Dietrich Reimer, 1902. *Presented through the Director of the Geological Survey, London.*

This is the fourth issue of the Geological map of Europe proposed by the International Geological Congress at Bologna in 1881, and executed conformably with the decision of an International Commission with the approval of the various governments, under the direction of MM. Beyrich, Hauchecorne, and Beyschlag. It is printed in carefully selected colours showing the various formations, and when complete will consist of forty-nine sheets, of which twenty-five have already appeared. The present part contains the following sheets: 3 (C I.) (almost a blank), eastern part of Jan Mayen island; 10 (C II.), Western Norway from the Lofoten islands to Aalesund; 17 (C III.), Southern Norway and Sweden; 11 (D II.), North part of the Gulf of Bothnia and surrounding portions of Finland and Sweden and Norway; 18 (D III.), Parts of Russia and Sweden around the northern Baltic and Gulf of Finland; 19 (E III.), St. Petersburg, Moscow, and neighbourhood; 26 (E IV.), Smolensk, Kursk, and the valley of the Dnieper.

Germany. **Konigl. Pruess. Landes-Aufnahme.**

Karte des Deutschen Reiches. Scale 1 : 100,000 or 1·6 stat. miles to an inch. Sheets: 173, Aurich; 176, Bremervörde; 177, Buxtehude; 207, Ottersberg; 260, Nienburg. Herausgegeben von der Kartogr. Abtheilung der Konigl. Preuss. Landes-Aufnahme, 1901. *Price* 1.5*m each sheet.*

Historical Atlas. **Poole.**

Historical Atlas of Modern Europe, from the Decline of the Roman Empire; comprising also maps of parts of Asia and of the New World connected with European History. Edited by Reginald Lane Poole, M.A., PH.D., Fellow of Magdalen College, and Lecturer in Diplomatic in the University of Oxford. Part xxviii. Oxford: The Clarendon Press; London Edinburgh, Glasgow, and New York: Henry Frowde, M.A.; Edinburgh: W. & A. K. Johnston. 1901. *Price* 3*s.* 6*d. Presented by the Clarendon Press.*

After an interval of about eighteen months, another part of this instructive atlas has appeared. There are yet two parts to be published to complete the work, and it is to be hoped that it may not again be found necessary to allow so long a time to elapse between the dates of issue. This part contains the following maps: No. 42, illustrating the growth of Prussia, 1415 to 1890. No. 66, Italy, c. 1167 to 1250. No. 83, India under Mohammedan Rule: The Kingdom of Delhi, A.D. c. 1340; The Moghul Empire at the death of Akbar, A.D. 1605. Mr. C. Grant Robertson, M.A., writes the letterpress for the map of Prussia, Miss Lina Eckenstein for that of Italy, and Prof. Lane Poole describes India under Mohammedan Rule.

Iceland. **Thoroddsen.**

Geological Map of Iceland. By Th. Thoroddsen. Surveyed in the years 1881 to 1898. Scale 1 : 600,000 or 9·5 stat. miles to an inch. Edited by the Carlsberg Fund, 1901. Copenhagen: A. E. Aamodt. 2 *sheets.*

This map shows the results of Th. Thoroddsen's geological investigations in Iceland, made during his extensive travels and surveys in the island from 1881 to 1898. Several maps, by the same author, have been previously published, showing the geology of different districts, but now these have been brought together, and the information shown upon one general map of the island.

ASIA.

Asia Minor. **Kiepert.**

Karte von Kleinasien. Scale 1 : 400,000 or 6·3 stat. miles to an inch. Von Dr.

Richard Kiepert. Sheets: A IV. Sinob; C III. Konia. Berlin: Dietrich Reimer (Ernst Vohsen), 1902. *Price 6 marks each sheet.*

Two additional sheets of Dr. R. Kiepert's new map of Asia Minor, which was noticed in the *Geographical Journal* for last month. Four other sheets, "Ermenek," "Karsarie," "Ünie," and "Adana," are now in the hands of the lithographer, and will doubtless be published before long.

Indian Government Surveys. **Surveyor-General of India.**

Indian Atlas, 4 miles to an inch. Sheets: 65, parts of districts Almora, Garhwál, Native State of Tehri Garhwál (North-Western Provinces), of district Kangra, Native States of Bashahr and Kanawar (Punjab), and of Hundes or Narikhorsuna and Monyal (Tibet), 1901; 42 S.E., parts of districts Shimoga, Kadur, and Chitaldrug (Mysore) and Dharwar (Bombay), 1899; 48 N.E., parts of districts Dehra Dun, Saharanpur, Garhwál, and Native State of Tehri Garhwál (North-Western Provinces), and districts Umballa, Karwál, and Native States of Sirmur, Pátiála and Kálsia (Punjab), 1900; 48 N.W., parts of districts Umballa, Ludhiana, and Karnál, and of Patiála, Nabha, Jind, Maler Kotla, and Kalsia, Native States (Punjab), 1897; 48 S.W., parts of districts Hissar and Karnál, and Native States of Patiála and Jind (Punjab), 1899; 48 S.E., parts of districts Dehra Dun, British Garhwál, Saharanpur, Muzaffarnagar, and Bijnor (North-Western Provinces), and Karnal and Umballa (Punjab), 1900; 52 N.W., parts of Native States Gwalior and Indore (Central India Agency), Udaipur, Tonk, Jhalawar, and Kotah (Rájputána Agency), 1899; 59 N.W., parts of districts Shimoga and Chitaldrug (Mysore State), Bellary, and Anantapur (Madras Presidency), and Dhárwár (Bombay Presidency), 1901; 71 N.W., parts of districts Narsinghpur, Saugor, Damoh, Hoshangabad (Central Provinces), and of Native States Bhopal Gwalior, Nawab Basoda, and Muhammadgarh (C. I. Agency), 1899; 71 S.W., parts of districts Narsinghpur Hoshangabad, Betúl, Chindwára, and Seoni (Central Provinces), and Native State of Bhopal (C. I. Agency), 1899; 72 S.W., parts of districts Nágpur, and Wardha (Central Provinces), and Amráoti of Berar (Hyderabad Assigned Districts), 1899; 78 N.W., parts of districts North Areot, Cuddapah (Madras Presidency), and of Kolar (Mysore), 1901.—Lower Provinces Revenue Survey, 1 mile to an inch. Sheets: 4, 5, District Purneah, additions to boundaries, 1897. 1901.—Assam Survey, 1 mile to an inch. Preliminary edition. Sheets: 16, Districts Kámrup and Goálpára, Seasons 1893–95 and 1896–97, 1901. 28, district Kámrup, Season 1885–86, 1901. 69, District Cachar, Season 1880–33. 1901.—Central India and Rájputána Survey, 1 mile to an inch. Sheets: 206, parts of Gwalior, Indore, Tonk, and Jaora (C.I. Agency), and of Udaipur and Partábgarh (Rájputána Agency), Season 1875–76, 1901. 227, parts of Native States Jaipur, and Jodhpur (Rájputána Agency), Season 1866–67, 1900. 229, parts of District Ajmer, and of Native States Jaipur, and Kishangarh (Rájputána Agency), Season 1868–69, 1901. 247, parts of Native States of Holkar, Dhár, Gwalior, and Barwáni (C.I. Agency), Season 1872–74, 1899. 320, parts of Gwalior (C.I. Agency), and Jaipur and Karauli (Rájputána Agency), Season 1864–66, 1901. 324, parts of Native States Gwalior (C.I. Agency), and of Kotah and Jhallawar (Rájputána Agency), Season 1870–71, 1899. 331, parts of Bhopal, Gwalior, Indore, and Dewas (C.I. Agency), Season 1877–78, 1899. 343, parts of Gwalior (C.I. Agency), and of Kerowli and Dholpur (Rájputána Agency), Season 1863–65, 1901. 347, parts of Native States Gwalior (C.I. Agency), and Jhalawar (Rájputána Agency), Season 1864–66, 1901. 365, part of Gwalior (C.I. Agency), Season 1863–64, 1900.—North-Western Provinces and Oudh Survey, 1 mile to an inch. Sheets: 14, district Saharanpur. Season 1878–80, 1900.—205, district Gorakhpur, Season 1885–88, 1901.—South-Eastern Frontier, 1 mile to an inch. Sheets: 1 N.W. (4th edit.), parts of districts North and South Lushai Hills, and Native State of Manipur (Assam), Hill Tippera (Bengal), and Chin Hills (Upper Burma), Seasons 1853–66, 1871–72, 1888–94, 1900. 4 N.W. (6th edit.), parts of districts Katha, Bhamo, Shwebo, Ruby Mines, and Northern Shan States (Upper Burma), Seasons 1886–95, 1901.—Berar or the Hyderabad Assigned Districts, 1885, 8 miles to an inch. Additions to 1900.—Calcutta and surrounding country (3rd edit.), 1 mile to an inch. 1900. 3 sheets.—Map of the country 10 miles around Calcutta (Fort William), 1 mile to an inch. 1901.—Mysore, 10 miles to an inch. 1900 (with an index).—Central Provinces, 80 miles to an inch. 1901.—District Mandla, Central Provinces, 8 miles to an inch. 1899.—Conventional signs to be used on topographical maps. 2 sheets.—*Presented by H.M. Secretary of State for India, through the Indian Office.*

Indo-China. **Lunet de Lajonquière.**

Atlas Archéologique de l'Indo-Chine. Monuments du Champa et du Cambodge par le Capitaine E. Lunet de Lajonquière. Scale 1 : 500,000 or 7·8 stat. miles to

an inch. Publications de l'École Française d'Extréme-Orient. Paris: E. Leroux, 1901. *Presented by l'École Française d'Extrême-Orient.*

Throughout Indo-China there are to be found numerous evidences of an ancient Hindu civilization in the form of ruins of temples, palaces, statues, and inscriptions: and although the existence of some of these has been known for years past, yet it is only recently, since the French have undertaken a survey of the country, that many others have been brought to light. This atlas shows the position and special character of a great number of these antiquities, and, so far as the area it includes is concerned, it appears to be very complete. It consists of four maps arranged in the following order: South Annam, North Annam, South Cambodia and North Cambodia, in addition to which there is a general map of the whole of Indo-China as an index, and upon which are also given the position of the principal temples, &c. lying outside the limits of the larger-scale maps. The sheets of the 'Carte de l'Indo-Chine,' on the scale of 1 : 500,000, now in course of publication by the Bureau Topographique des Troupes de l'Indo-Chine, serve as a basis for the atlas. Upon these the archæological information, including also the sites of old bridges, roads, etc., is shown in red. In some instances corrections and additions have been made to the topography of the country as previously shown on the maps. The atlas also contains tables giving the names and situations of the antiquities and points of archæological interest which are laid down upon the maps. The portion of Cambodia here dealt with is only that occupied by the French; later on it is intended to publish a supplement to the present work, giving similar information concerning Siamese Cambodia.

AFRICA.

Sahara. **Mission Coppolani.**

Carte de la Mauritanie Saharienne. Scale 1 : 1,000,000 or 15·8 stat. miles to an inch. D'après les documents relevés sur place et les renseignements de source indigène recueilles par la mission Cappolani chez les Maures et les Touareg, et les itineraires connus. Paris: A. Challamel, 1902. 4 sheets.

This large four-sheet map shows the whole of the Sahara, from the Wadi Draa on the north to the Niger below Timbuktu on the south, and from the Atlantic coast on the west to the meridian of Paris on the east. As M. Coppolani's mission travelled only in the region of the Senegal and Niger, with the exception of a journey into the Sahara to the north of Timbuktu as far as Arawan (in about lat. 19° 10′ N.), it is evident that by far the greater part of this map is compiled from the work of other explorers and native reports. Many areas are still unexplored, but the map contains a great deal of information, of a more or less reliable character, as well as the routes of several other travellers. It is clearly printed in colours. An inset plan of Arawan and neighbourhood is given.

West Africa. **Bourdariat.**

Carte de la Côte d'Ivoirie. Scale 1 : 600,000 or 9·5 stat. miles to an inch. Par A. J. Bourdariat. Paris: H. Barrère.

Compiled from the author's own surveys and observations as well as from those of other travellers, including the maps of Binger, Marchand, Pobéguin, and Spicq. It is to a great extent a mining map, and shows the limits of the region open to the exploitation of mines, the areas concerning which *permis de recherches* were sought and granted between January 1 and November 15, 1901, as well as a list of persons and companies holding concessions, and other information of a kindred character. Travellers' routes and proposed railways are also shown.

AMERICA.

Argentine Republic. **Argentine Boundary Commission.**

Sixteen Maps of the Cordillera de los Andes. From the surveys of the Argentine Boundary Commission. (1) N.W. Region of the Argentine Republic, 1 : 1,000,000; (2) Region between 38° 50′ and 41° 10′ S. lat., showing the proposed Argentine and Chilian boundary-lines, 1 : 500,000; (3) Ipela ridge and lakes Huechu-Lafquen, Lolog and Lacar, between 39° 40′ and 40° 30′, 1 : 100,000; (4) Region between 41° 0′ and 43° 40′ S. lat., showing the proposed Argentine and Chilian boundary-lines, 1 : 500,000; (5) Region between 43° 0′ and 45° 20′ S. lat., showing the proposed Argentine and Chilian boundary-lines, 1 : 500,000; (6) Showing the Continental divide in the Tertiary tableland between 43° 30′ and 44° 45′ S. lat., 1 : 100,000; (7) Region between 45° 0′ and 47° 20′ S. lat., showing the proposed Argentine and Chilian boundary-lines, 1 : 500,000; (8) Headwaters of rivers Aisen and Mayo, between 45° 14′ and 46° 10′, 1 : 200,000; (9) Valley of lake Buenos Aires and rivers Fenix and Descado, 1 : 100,000; (10) Region between 47° and

49° 30′ S. lat., showing the proposed Argentine and Chilian boundary-lines. 1 : 500,000; (11) Region between 49° 30′ and 52° 30′ S. lat., showing the proposed Argentine and Chilian boundary-lines, 1 : 500,000; (12) Orographical preliminary map of the S.W. Region of the Argentine Republic, 1 : 1,000,000; (13) Preliminary map of the S.W. Region of the Argentine Republic, 1 : 1,000,000; (14) Preliminary map of the S. Region of the Argentine Republic, 1 : 1,000,000; (15) Region between 50° 40′ and 52°, showing proposed Chilian boundary-line, 1 : 200,000; (16) Region between 50° 40′ and 52°, showing proposed Argentine boundary-line, 1 : 200,000. *Presented by the Argentine Boundary Commission, through Dr. F. P. Moreno.*

Whatever may be the political results of the dispute between the Argentine Republic and Chile concerning their boundary in the Andes, it is certain that the cause of geography will profit considerably by it. As has often been the case under similar circumstances, very little was known of most of the disputed districts until this difficulty arose, and it became necessary to despatch properly organized expeditions to survey and map them. An inspection of the sixteen maps in this portfolio will show how much has already been accomplished by the surveyors of the Argentine Boundary Commission on the eastern slopes of the Andes, while quite recently much fresh information has been obtained which will be published later on. The Chilians have, for a long time past, also been engaged in survey work, so before long we may hope to possess a fairly perfect map of the central and southern Andes.

New York. **Stevens.**

B. F. Stevens's Facsimile of the Unpublished British Head Quarters Coloured Manuscript Map of New York and Environs (1782). Reproduced from the original drawing in the War Office, London. Scale about 6½ inches to a mile. Issued only to subscribers at 4, Trafalgar Square, London, 1900. 24 sheets. *Price* £5 5*s.*; or mounted and folded in case, £6 6*s.*

The original plan, of which this is a facsimile, was made from surveys by Engineer officers during the British occupation of New York from 1776 to 1783. It is drawn on the scale of about 6½ inches to a mile, and extends from just below Guanas bay to the heights of Spikendevil, and thus includes the whole of New York island and a great part of Brooklyn, as well as a portion of the New Jersey shore in the neighbourhood of Paulus Hook. When the British evacuated New York this plan was brought to London and deposited at the War Office, where it has been ever since. Mr. Stevens has now published a limited number of facsimiles, in twenty-four sheets, which will be of great service to historians and all those interested in the study of this important period of American history. The plan is coloured, and shows the then existing fortifications, defences, buildings, streets, roads, on New York island, as well as river frontages and military works on Long Island, Paulus Hook, and the shores of New Jersey. There is a complete explanatory table and an index plan.

AUSTRALASIA.

New Zealand. **Department of Lands and Survey, Wellington.**

Map of New Zealand. Scale 1 : 982,080 or 15·5 stat. miles to an inch. Wellington: Department of Lands and Survey, 1901. 2 sheets.

Boundaries of countries, with their names, are shown in red. There is no hill-work, but altitudes are given in figures. Railways and roads are shown.

GENERAL.

World. **Schrader.**

L'Année Cartographique. Supplément annuel à toutes les publications de Géographie et de Cartographie. Dressé et rédigé sous la direction de F. Schrader. Onzieme supplément. Contenant les modifications Géographiques et Politiques, des Années 1899–1900. Paris: Librairie Hackette et Cie., 1902. *Price* 3 *francs.*

For the past eleven years this little publication has been issued under the direction of M. F. Schrader, and although the maps are on small scales, and the accompanying letterpress is necessarily very brief, it has proved decidedly useful as a summary of the principal geographical events for general reference. The present issue, showing the geographical progress during 1899–1900, contains three sheets of maps, the first of which is devoted to Asia, the second to Africa, and the third to America. The sheet for Asia gives the results of Captain H. H. P. Deasy's surveys in Central Asia; a map of French Indo-China showing administrative divisions, another of Southern Annam, and a small inset of the French territory of Kwang-chau. There are eight

small maps on the African sheet, the principal of which show recent explorations and explorers' routes in French Congo, Southern Abyssinia, and the upper Zambezi. The map of Southern Abyssinia, however, does not give the work of Mr. J. J. Harrison's expedition, nor his route. The other maps on this sheet consist of French West Africa showing administrative divisions, the Ivory Coast, the lake region from Tanganyika to Albert Nyanza and Northern Rodesia, and the Anglo-German frontier between Nyasa and Tanganyika. On the sheet for America there are maps showing the regions in dispute between Chili and Argentina, from the surveys of the Argentine Boundary Commission, the explorations of Captain H. Bolland along the Rio Bermejo-Teuco; the Rio Uaupès, from a complete survey by Count E. Stradelli; Mr. D. Hanbury's explorations in the neighbourhood of Chesterfield inlet, and a map of Southern Brazil showing the railways. Descriptive letterpress is as usual given upon the back of each sheet.

World. **Smith.**

Foreign Mission Atlas. Edited by Dr. George Smith, C.I.E. Edinburgh: Foreign Mission Office, 1902. *Presented by the Foreign Mission Office.*

A useful little reference atlas for those interested in the work of foreign Christian missions. The maps, which are twelve in number, are by Bartholomew, and show the names of the mission stations of the United Free Church of Scotland underlined in red. There is also a list of the mission stations, with the date of their foundation.

CHARTS.

Admiralty Charts. **Hydrographic Department, Admiralty.**

Charts and Plans published by the Hydrographic Department, Admiralty, during November and December, 1901. *Presented by the Hydrographic Department, Admiralty.*

No.	Inches.	
3207 m	= 6·8	Northern entrance to Achill sound, including the approaches to Tonregee. 2*s.* 6*d.*
3215 m	= 1·5	France, west coast:—Goulet de Fromantine to Pointe de St. Gildas. 2*s.* 6*d.*
3166 m	= 3·0	West Indies:—Puerto Rico island, Jobos harbour. 1*s.* 6*d.*
3188 m	= 1·8	Central America:—Gulf of Mexico, Sabine pass. 1*s.* 6*d.*
1284 m	= 0·07	South America, east coast:—Cape Dos Bahias to Staten island. 2*s.* 6*d.*
3226 m	= 1·4	South America, east coast:—Port Santa Cruz. 2*s.* 6*d.*
616 m	= 1·0 / 8·0	Africa, west coast:—Sierra Leone river and anchorage. 2*s.* 6*d.*
3211 m	= 5·9	Africa, east coast:—Zanzibar island. Zanzibar harbour. 2*s.* 6*d.*
1988 m	= 0·72	China, east coast:—Approach to Samsa inlet. 2*s.* 6*d.*
3184 m	= 5·9	China, Plans in the Yang Tse Kiang:—Itu reach. 1*s.* 6*d.*
3216 m	= 9·0 / 7·5 / 9·0	Japan:—Plans on the east coast of Nipon island: Nakanosaku. Hakuchi, Naka Minato, Hirakata wan. 1*s.* 6*d.*
3186 m	= 0·5	Australia, north-west coast:—Mary Ann passage and approaches. 2*s.* 6*d.*
3187 m	= 0·5	Australia, west coast:—Mangrove islands to North-west cape. 2*s.* 6*d.*
3221 m	= 2·95	Plans on the south coast of Australia:—Duke of Orleans bay, Goose island bay. 1*s.* 6*d.*
2662		Celebes:—Ports in Makassar strait. Plans added:—Lingadang road and Belonlioh bay, Pambauwang road, Chinrana and Binanga bays.

(*J. D. Potter, Agent.*)

Charts Cancelled.

No.		Cancelled by	No.
954	Achill sound, northern entrance.	New plan. Northern entrance to Achill sound	3207
1639	Sabine pass, plan on this chart.	New chart. Sabine pass	3188
1284	Cape Three points to the strait of Magellan.	New chart. Cape Dos Bahias to Staten island	1284
1292	Plan of Port Santa Cruz, on this sheet.	New plan. Port Santa Cruz	3226
538	Anchorages on east coast of Vancouver island.	New plans of same anchorages	538

No.		Cancelled by	No.
616	Plan of Sierra Leone river.	New chart. Sierra Leone river	616
2196	Wowoni strait, etc. Plan on this sheet.	New plan of same on same sheet	2196
2662	Plan of Cape Rivers and Chinrana bay on this sheet.	New plans. Lingadang road and Belonlioh bay, Chinrana and Binanga bays	2662
1988	Sam sa bay and inlet.	New chart. Approach to Sam sa inlet	1988

Charts that have received Important Corrections.

No. 1991, England, south coast:—Folkestone harbour 1951, England, west coast:—Liverpool bay 1975, England, east coast:—River Thames: Kentish Knock to the West Swin. 2693, England, east coast:—Orwell and Stour rivers. 2845, England, Channel islands:—Alderney harbour. 1297, Norway:—Lepsö to Ona. 1298, Norway:—Approaches to Molde. 1972, Norway:—Approaches to Trondhjem, eastern sheet. 1343, France, west coast:—Adour river from the entrance to Bayonne. 1422, North America:—Labrador. 327, Lake Huron:—Georgian bay. 2908, Africa, south coast:—Port Natal entrance. 1003, Africa, east coast:—Pungue river, Beira harbour. 759A, Madagascar:—Cape St. Andrew to Bevato island. 143, Red sea:—Jebel Teïr to Perim island. 2413, Malacca strait:—Rhio strait. 1789, Malacca strait:—Channels between Sumatra and Linga. 941B, Eastern archipelago:—Western portion. 942A, Eastern archipelago:—Eastern portion. 3044, Celebes:—Ujong Jonga to Ujong Kassi. 2636, Philippine islands:—Strait of Makasser, north part. 2391, Philippine islands:—Port Ilo Ilo. 975, Philippine islands:—Port Kavite. 2660B, China sea:—Southern portion. 2357, China, north coast:—Ching Wang Tao road. 1708, Australia, sheet II:—Albert river. 917, Australia, west coast:—Harbours and anchorages on the west coast. 1700, Australia, west coast:—Fremantle harbour and Gage roads. 1059, Australia, south coast:—Doubtful island bay to the head of the Great Australian bight. 2984, Australia, south coast:—Esperance bay. (*J. D. Potter, Agent.*)

North Atlantic Ocean and Mediterranean Sea. **Meteorological Office, London.**

Pilot Chart of the North Atlantic and Mediterranean for February, 1902. London: Meteorological Office. *Price 6d. Presented by the Meteorological Office, London.*

Russian Charts. **Chief Hydrographic Department, Ministry of Marine, St. Petersburg.**

Baltic.

No.	
1825	Southern part of the Baltic from Rugen to Warnemünde. Scale 1 : 100,000 or 1·6 stat. mile to an inch. 1901.
1826	Southern part of the Baltic from Warnemünde to Femern island. Scale 1 : 100,000 or 1·6 stat. miles to an inch. 1898.
566	Plan of Windu. Scale 420 feet to an inch. 1900.

North Pacific.

1829	Plan of Vostok bay. Scale 1400 feet to an inch. 1899.
577	Index to charts on the North Pacific coast from Posiette bay to America bay. 1901.

United States Charts. **United States Hydrographic Office.**

Pilot Charts of the North Atlantic for January, and North Pacific for February, 1902. U.S. Hydrographic Office, Washington, D.C. *Presented by the U.S. Hydrographic Office.*

PHOTOGRAPHS.

N.B.—It would greatly add to the value of the collection of Photographs which has been established in the Map Room, if all the Fellows of the Society who have taken photographs during their travels, would forward copies of them to the Map Curator, by whom they will be acknowledged. Should the donor have purchased the photographs, it will be useful for reference if the name of the photographer and his address are given.

TRAVERSE

across the

YA LUNG, YANGTSE, MEKONG & SALWEN RIVERS,

TO THE

IRAWADI.

BY

R. LOGAN JACK, L L.D., F.G.S.

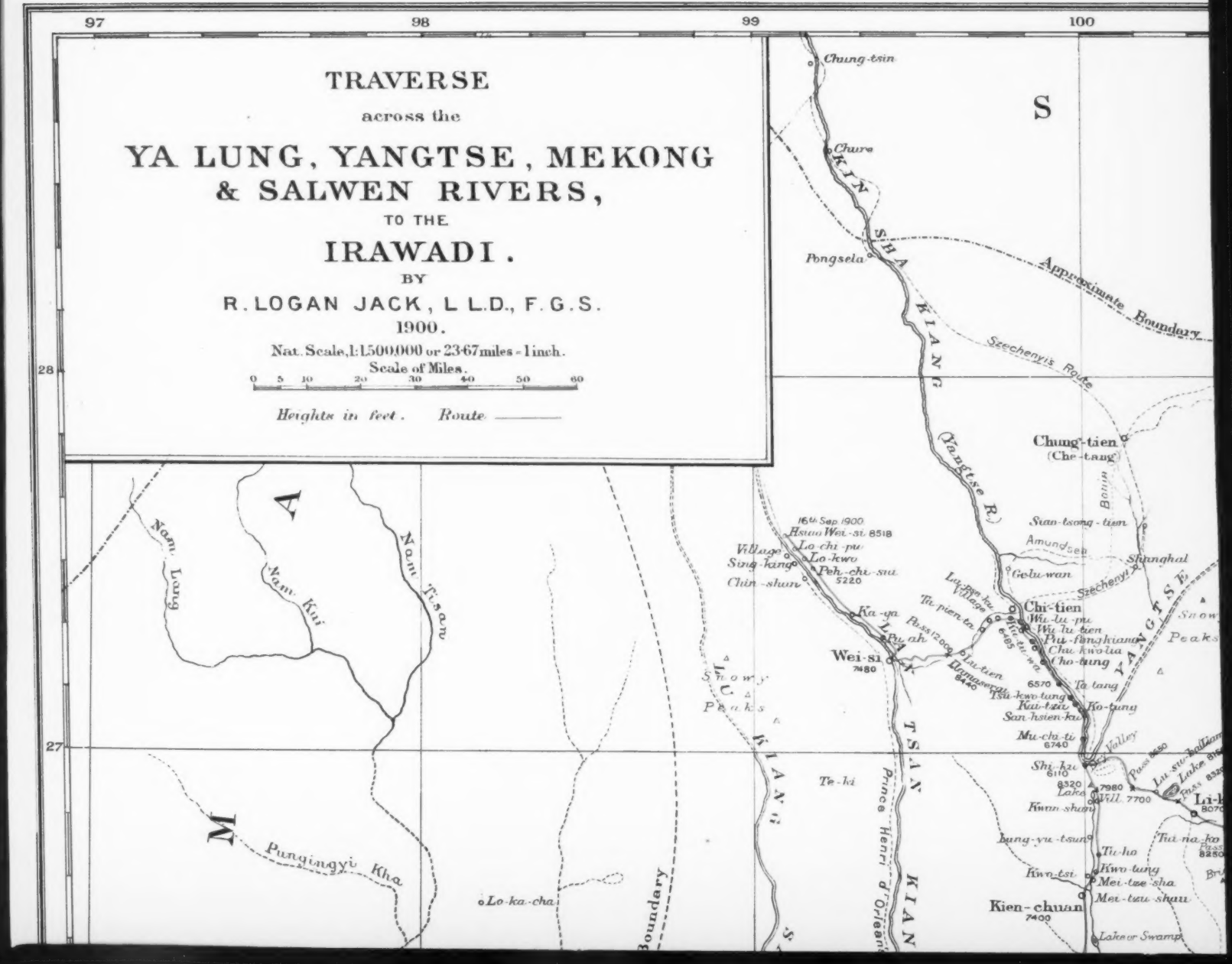
1900.

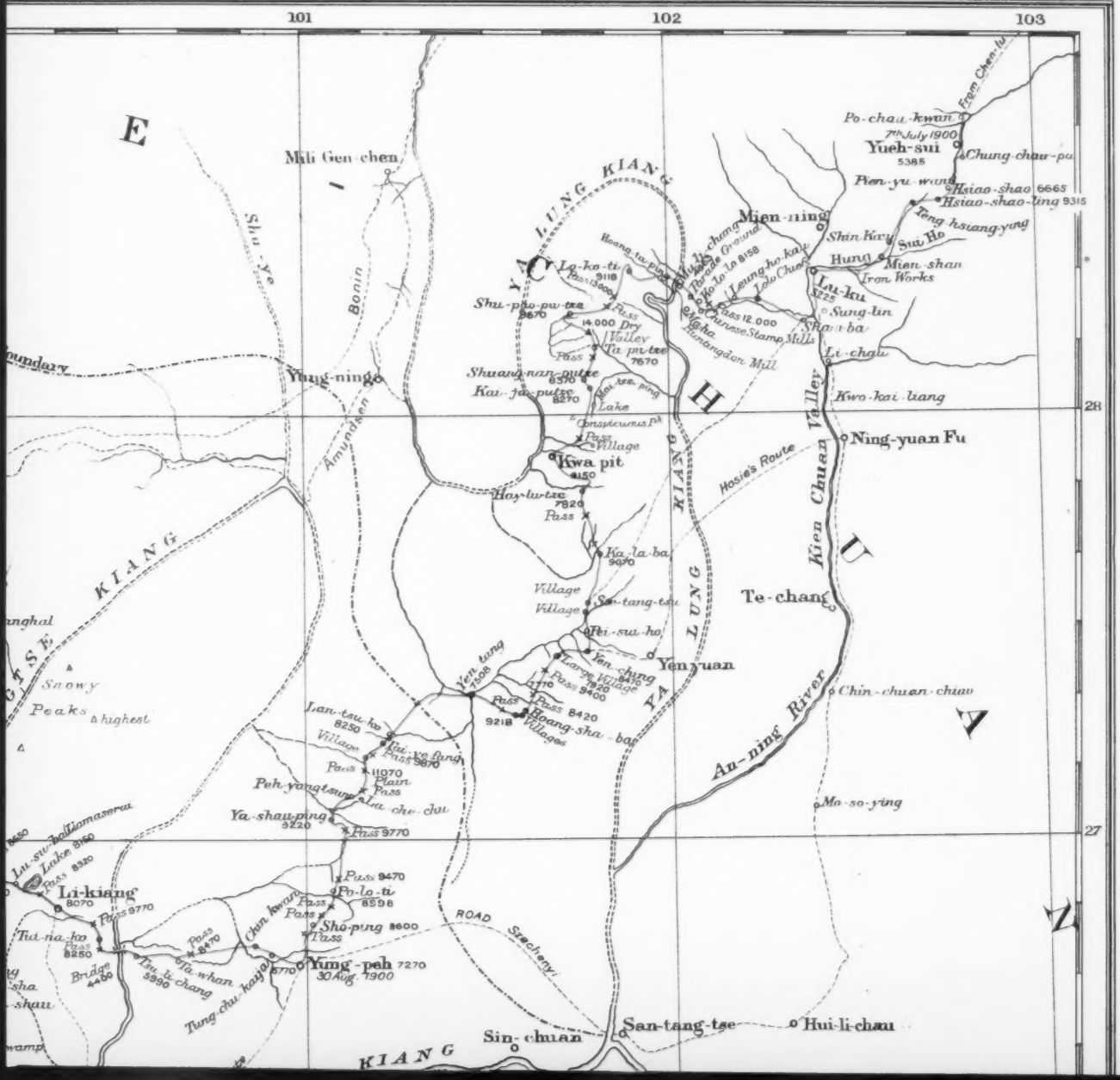
Nat. Scale, 1:1,500,000 or 23·67 miles = 1 inch.

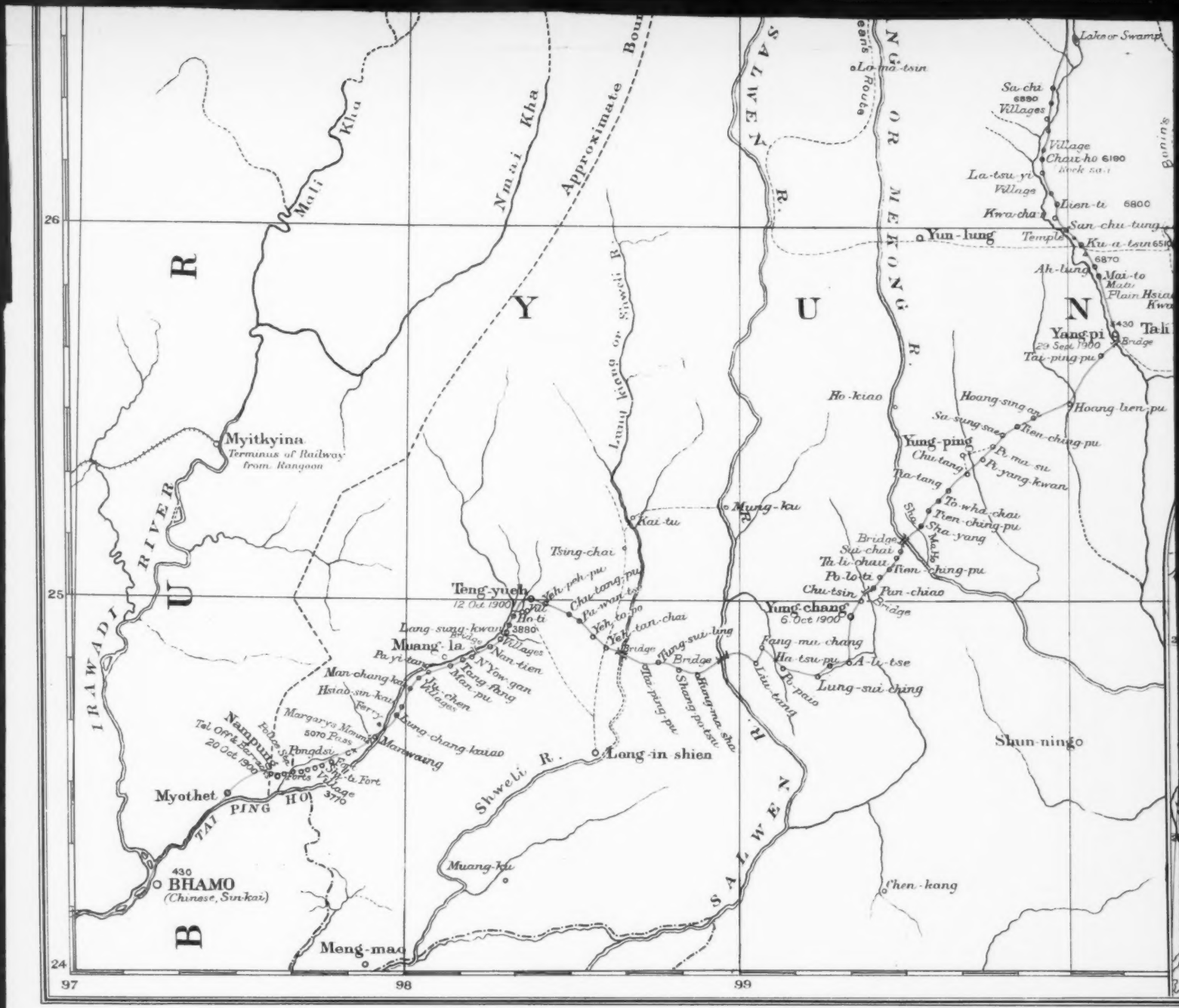
Scale of Miles.

0 5 10 20 30 40 50 60

Heights in feet. *Route* ———




101
102
103
28
27
E
Mili Gen-chen
Shu-ye
Bonin
Amundsen
Yung-ning
Kwa pit
8150
Hay-lu-tze
7820
Pass
Ka-la-ba
9970
Village
San-tang-tse
Pei-sui-ho
Yen-tung
7508
Yen-chung
8420
Yen-yuan
Lan-tsu-ho
8250
Pass 9218
Hoang-sha-ba
Villages
Peh-yang-tsung
Ya-shau-ping
9220
Pass 9770
Li-kiang
8070
Pass 9770
Tui-na-ko
Pass
8250
Bridge
4460
Tsu-la-chang
5990
Tung-chu-kaiya
5770
Yung-peh 7270
30 Aug. 1900
Sho-ping 8600
Pass
Po-lo-ti
8598
Pass 9470
Pass 9470
Chin-kwan
Pass
Sin-chuan
San-tang-tse
Hui-li-chau
ROAD
Szechenyi
KIANG
Snowy
Peaks
highest
Mien-ning
Shan Kwy
Sui Ho
Hung
Mien-shan
Iron Works
Lu-ku
3225
Sung-lin
Shan-ba
Li-chau
Kwo-kai-liang
Ning-yuan Fu
Kien Chuan Valley
Hosie's Route
Te-chang
An-ning River
Chin-chuan-chau
Mo-so-ying
Po-chau-kwan
7th July 1900
Yueh-sui
5385
Chung-chau-pu
Pien-yu-wang
Hsiao-shao 6665
Hsiao-shao-ling 9315
Teng-hsiang-ying
From Chen-tu
Pass 13000
14,000 Dry Valley
Pass 12,000
Chinese Stamp Mills
Hantangdan Mill
Lake
Conspicuous Pk
Village
Pass
Lake
Pass 9470
Pass 9770
Pass 9470
Pass 11070
Plain
Pass
Pass 9770
Pass 8420
Pass 9400
Pass 9470
Large Village
Village
Pass
Pass
Pass



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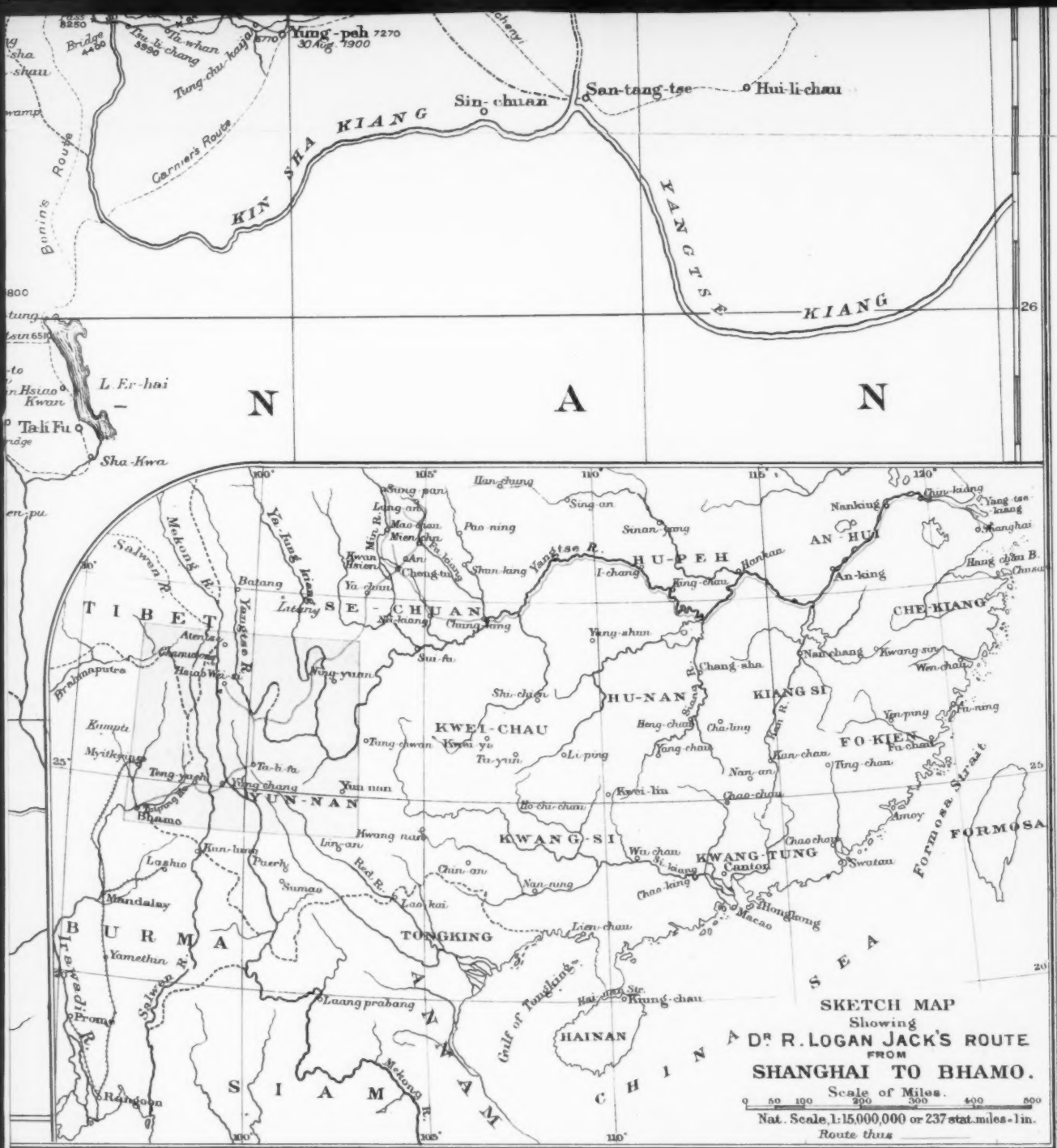

al Society.

H. Manly, lith.